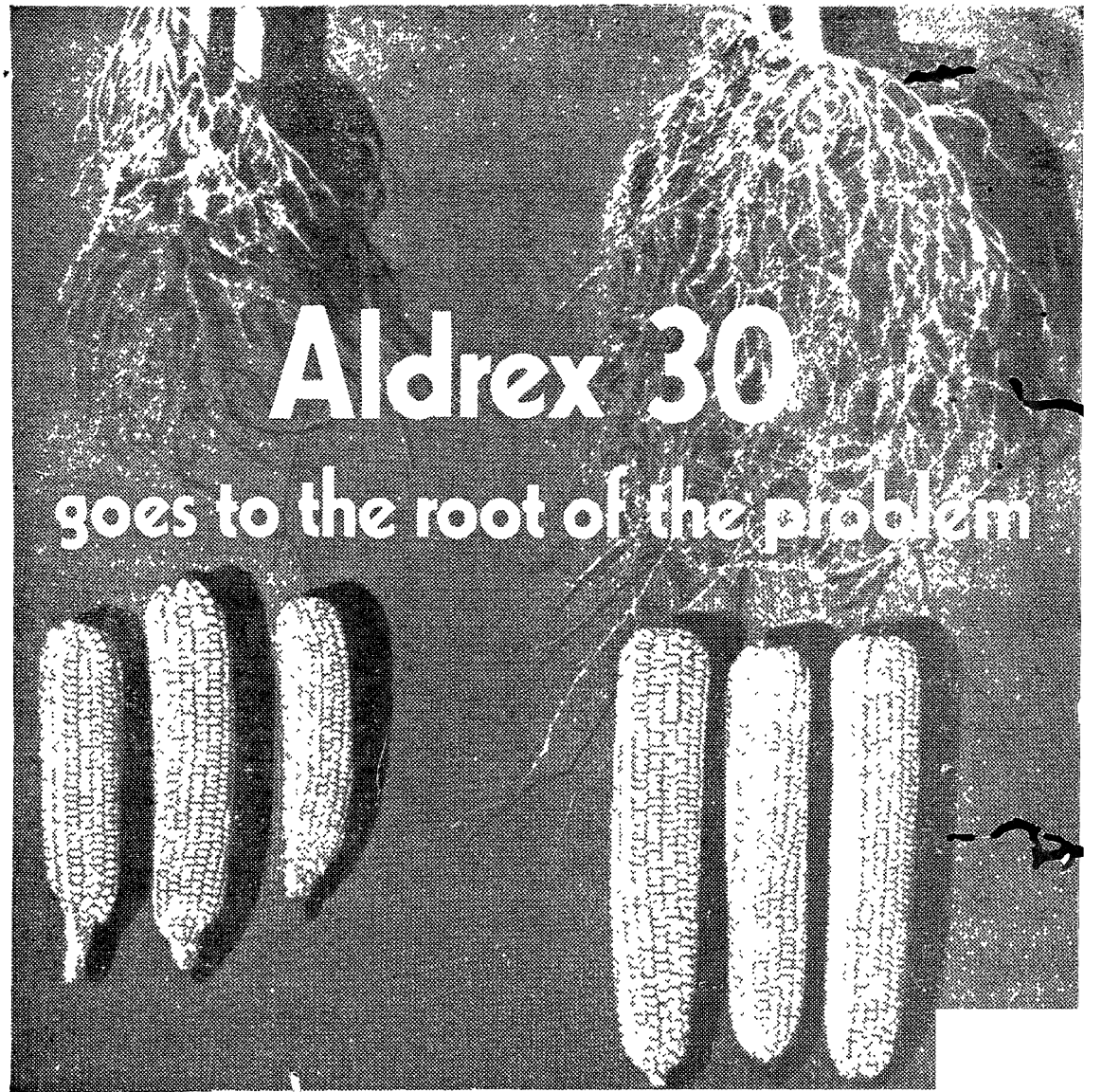

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देवा भागं यथा पूर्वे सं जानाना उपासते ।।

ऋग वेद १०।१९१।२

O my men ! You should all move and work together in a cooperative spirit; your mutual conversation should always be pleasant and courteous; your mind should be full of high thoughts; and you should perform your duties with the same devotion and steadfastness as learned and worldly wise people did in the past.

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FARMER AND PARLIAMENT

VOL. XI NO. 1 JANUARY 1976

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if our expenses were laid out rather in the
necessaries than the superfluities of life,
there might be fewer wants and even fewer
pleasures, but infinitely more happiness.

—*GOLDSMITH*

Editor's Page

It is a matter of great satisfaction that there is now a growing realisation in the country about the vital importance of Agriculture in the Indian economy. The events of the last decade have fully established that unless agriculture develops rapidly and on a sound basis the economy of the country cannot be strengthened. The industrial sector of the country has made considerable progress during recent years. But its progress also depends to a large extent on the progress of agriculture. The failure of agricultural production in a year immediately affects adversely the industrial sector of the country also, as there is shortage of raw materials for the industry and the demand for industrial goods declines particularly in the rural areas.

The fact that about 80 per cent of the people live in villages and depend directly or indirectly on agricultural production for their livelihood, clearly shows that without proper development of agriculture, the economy of the country cannot be put on a sound footing.

Agriculture contributes more than 50 per cent of the national income and its share in the export trade is also of the same order. It is, therefore, obvious that if the general standard of living of our people particularly in the rural areas, is to be raised and the economy of the country is to be put on a sound footing, the agricultural sector must be developed at a rapid pace.

Ex-President Nixon of U.S.A., in a recent speech in China, also said that those developing countries who made the mistake of ignoring agricultural sector and laying undue emphasis on industry, had to pay a heavy price as without a strong agricultural base industry could not really be developed. In U.S.A. itself, the industrial sector had made progress only after the agricultural base of the country became strong. In Japan, it was after the Meiji Restoration in 1868, when agricultural reforms were introduced and agriculture was put on a sound footing, that the industrial sector started looking up.

Realising the importance of agriculture in the Indian economy, the Prime Minister has also laid special emphasis on the development of agriculture in the 20-point economic programme. The implementation of Agricultural land ceiling and speedier distribution of surplus land and compilation of land records is an essential part of the 20-point programme. Special emphasis has also been laid in the programme on the development of irrigation potential of the country. The target of bringing five million more hectares of land under irrigation and development of the underground water resources of the country, has been fixed under the 20-point programme. The importance of adequate and timely supply of water for the growth of plants cannot be over-emphasised. Without supply of water plants cannot be grown. All other inputs such as improved seeds, fertilisers, improved agricultural practices etc. become useless if adequate and timely supply of water is not available. We do hope that the central and State Governments would do all in their power to implement the programme for development of the irrigation potential of the country. We have still to go a long way in exploiting in full the surface and underground water resources of the country. The Nature has endowed India with enormous water resources and if these are harnessed properly the agriculture can get a big boost.

There is still another factor which is of equal importance in developing the agricultural sector of the country. It is the remunerative and incentive price which helps to build up necessary enthusiasm in the farmer to put in his best to increase production. If the price is not remunerative enough he loses heart. It is, therefore, of paramount importance that the price paid to the cultivator should be adequately remunerative in the context of the present high cost of cultivation. It is only then that the farmer could be expected to put in his heart and soul into agriculture and try to increase agricultural production.

In highly developed countries like U.S.A. farmers are paid subsidy on each tonne of agricultural produce sold in the market. And this sub-

(*Contd. on page 28*)

Brown Plant Hoppers Can Rain Your Rice Crop.

Suddenly, in the midst of the lush-growing rice, field, there are elusters of clumped plan plants. Ugly burnt patches appear here and there. The patch spreads. Before long, the crop dries up and is lost to the grower. Many paddy farmers in West Bengal, Kerala, Andhra Pradesh and Tamil Nadu have become familiar to such damages in recent years. Also they now know who the culprit is: a whitish brownwish insect—Brown Plant Hopper is the name.

Yes, the brown plant hopper (the scientists call *Nilaparvata lugens*) has become a big menace to rice growing, especially where thc crop is intensively cultivated.

The nymphs and adults suck the sap from the base of the plant before they are actually discovered. The first visible symptoms like slumped plants and burnt patches, now called "Hopper burn", appear later.

The brown plant hopper prefers thick vegetation and hence the crop grown with exessive nitrogen is more likely to be attacked. High yielding varieties are most susceptible. What's most alarming is that the pest is multiplying and spreading rapidly. The rice crop can be saved only if the growers are on the alert and take immediate control measures.

For such timely action, you have really to look for the pest as theo might escape notice at the early build up stage. Visit the fields more frequently and inspect the base of plant at random. Better tap the plants and see whether any whitish-brownish insects have fallen on the water surface. If they have, it is a signal for you to act.

What to do

If you find 5 to 10 nymphs or adults per hill, take immediate control measures as per stage of the plant growth with any one of the suitable insecticides.

At nursery stage apply Carbofuran or Diazinon or Thimet of Sevidol granules at 0.75 kg a.i. per hectare. Or spray thoroughly either with Sevin or Dimecron at 0.4 kg. a.i. per hectare.

If you find the pest on the early transplant crop, spray Sevin or Nuvacron or Dimecoron at the rate of 0.4 kg a.i. per hectare. Spray nozzle should be directed towards the basal portion of the plant for effective control.

The same control measures will be effective if the crop is attacked at the mid-tillering stage.

Choose from Carbofuran or Thinet or Diazinion or Sevidol or Cytrolane at the rate of 1 kg. a.i. per hectare during panicle initiation to booting stage. Or spray with suitable insecticides, as recommended earlier.

During flowering to hard dough stage, dusting with BHC 10 per cent at the basal portion of the plants is recommended. Dusting should be done during afternoons.

Providing allays after every two meters has been found good for surveillance as well as for taking effective control measures. (FIU)

Timely Steps To Save Tomatos From Borers

Spraying the tomato crop with 0.2 per cent Sevin or Malathion 0.15 per cent or Fenetrothion 0.08 per cent every 10 days, starting from flowering can keep the tomatoes safe from the fruit borers.

The Caterpillars of the tomato fruit borers feed on the leaves of the seedlings. As larvae, the pest bores into the fruit. Normally, it migrates to tomato plants from the neighbouring gram fields around February—March, when its population reaches its peak in the pulse crop.

The chemicals are to be used at 800 litres per hectare. Fruits should be picked at least three days after spraying.

Hand-picking of larvae, uprooting the affected crop and ploughing the field soon after harvest go a long way in keeping down the borers. (F.I.U.)

Milch Animals and Diseases of Uterus

P. G. Supekar
Associate Professor of Medicine,
Veterinary College, Mhow (M. P.)

It is well recognised that in a sexually mature animal the role of the reproductive organs assumes great importance, since smooth and orderly function of these organs helps the cattle owners to raise the new progeny and achieve success in their husbandry practice. This statement is very true in case of animals participating in a regular breeding programme such as the dairy animals.

A successful cattle owner achieves such a reputation only when the success in getting an optimum and uninterrupted production from his animals. This also means a continuous inflow of revenue. To achieve this he has to take all care and precaution in the matters of breeding, management, beeding and disease control of animals of his herd, which would ultimately ensure the dropping of a healthy calf each year and an increasing yield of milk. Any advertent or inadvertent lapse in any of these practices would be reflected as a shortfall in production and economic returns expected from the animals.

A successful implementation of all these practices means that a milk cow is in a state of pregnancy more or less continuously. Following a calving, the cow is again mated in about 60-70 days and this cycle is repeated over and over again till the reproductive and economic productive life of the animal lasts.

Such a plan of production necessitates an uninterrupted activity of the reproductive organs particularly the uterus which harbours, protects, nourishes the embryo. It also means that the tissues of the uterus hardly get a period of rest. In fact these tissues have no rest at all, since in the short period between a calving and following conception, these are engaged in involutionary activity which is so vital to the success of a continuous breeding programme.

It is, therefore, no surprise that the tissues of the uterus get completely exhausted, lose their optimal vitality and resistance and fall an easy prey to the onslaught of a variety of infective microbes reaching the uterus via the blood, on the male genital organ, with the inproperly sterilized inseminating equipment and appliances and those used by a veterinarian during gynacological examination of animals. These microbes initiate a number of stressful disease conditions which sap the vitality and productive capability of the milch animals. Of these reproductive diseases, the more important ones are discussed here under.

Metritis and Pyometra : These conditions are usually seen after a calving. When proper sanitary precautions are not taken during a calving, dirty and unsterilized ropes, instruments and appliances are used during a difficult parturition or at the time of an insemination, a variety of infective micro-organisms enter the uterus and initiate inflammatory changes in the tissues. This condition is known as Metritis. In this condition pus is formed and it gets discharged to the outside via the vagina as a dirty coloured, foul smelling fluid. The discharge gradually increases in amount and may continue to flow for a long period, as long as the 'os' or mouth of the uterus happens to remain open.

If the os of the uterus gets closed, the discharge gets accumulated within the uterus, which swells up in size and becomes turgid. This is the condition of pyometra. Following a case of pyometra the micro-organisms can invade the blood stream, cause septicaemia and affect other tissues and organs of the body.

Whether it be a case of metritis or pyometra, the normal breeding programme gets disrupted, production and health of the animals is also adversely affected. The cattle owners have to sustain a financial loss due to these conditions.

A well informed attendant or animal owner can easily recognise these conditions and seek the assistance of a Veterinarian for a prompt and proper treatment of the case. This mainly involves an evacuation of the discharges from the uterus, cleaning the uterus from within and placing of anti-microbial drugs in the uterus to prevent any further pus formation. This should always be done under the guidance of a Veterinarian.

Efforts should be made to prevent these conditions. For this purpose emphasis must be laid on

the cleanliness of the animal and its environment. All the appliances used for insemination, during a difficult calving and for gynaecological examination of the calves should always be properly sterilized.

Placentitis : The pathogenic micro-organisms can force their entry into the uterus immediately preceding the conception and cause an inflammation of the placenta the covering which surrounds the foetus on all sides. Such a condition is known as placentitis and can be caused by some particular micro-organisms only, eg. Brucella abortus; Vibrio; foetus Tritrichonsonas foetus etc. Following such an inflammation, the close relationship between the foetus and the mother at the cotyledons, becomes loose and after a time snap off finally. As a consequence of this break up of relationship, the pregnancy gets terminated, the foetus becomes harmful for the mother. Who the, throws out the foetus. This is an abortion. An abortion caused by different micro-organisms may be seen at different stages of pregnancy i.e. either in the 4th, 6th or 8th month. Be it at any stage, it causes a sudden disruption of the breeding programme and a great loss to the cattle owner.

Usually no clear cut symptoms are seen before an abortion occurs and it is a sudden occurrence. This may be followed by abortions in the following pregnancies as well.

In the event of an abortion taking place on a farm, the aborted animal should be looked after with due care. Cleanliness of the reproductive organs should be ensured to avoid an initiation of metritis or pyometra etc. This should, then, be followed by a complete check up of the animal by a Veterinarian to ascertain the precise cause of abortion and on his advice necessary precautionary measures should be brought into effect.

To protect the animals of a herd against infection by brucella abortus, the female calves of 6-12 month age group are vaccinated with a vaccine—cotton strain 19 vaccine. All the young animals in the herd should be so protected. Other preventive measures are the same as enumerated above. Another important measure is to ensure that the females in a herd are mated only to such males as have been tested are known to be free of these infections. Where artificial insemination is the method chosen for breeding of the animals ensure that the semen used does not carry the infection.

Retained placenta : This is a very common complaint amongst regular breeding animals. This may be caused due to a number of factors such as debility due to disease, old age, exhaustion of the cow following a prolonged parturition etc. in such cases the animals fail to throw out the placenta following its calving. Retained placenta is also seen in animals which have suffered from brucellosis, usually in the third pregnancy following first abortion.

In this condition the placenta fails to come out —either fully or partially—is seen hanging from the vagina, gets decomposed and causes an inflammation of the uterus i.e. metritis. The symptoms of metritis, then, supervene with the additional observation that fragments of the decomposing placenta come out with the discharge from the uterus.

A case of retained placenta can be spotted easily. In cases where the placenta fails to be thrown out in 12-18 hours following a calving, one can suspect its retention. This can be confirmed by an examination of the animal.

The treatment of a case of retained placenta is on parallel lines to that of metritis ; with the additional requirement that pieces of the placenta in the uterus should be carefully removed. Care should be taken to ensure that removal of the placenta is done slowly and no injury to the uterine wall is caused as a result of rough handling of the case. This can cause further damage and stress to the animal.

This condition can and should be prevented. Prevention can be achieved by controlling the microbial infections which cause the retention. Efforts should also be made to avoid debility of pregnant animals, exhaustion of animals at calving time. In all cases where the placenta gets retained, immediate steps should be taken to remove it so that the animals do not have to suffer other harmful conditions like metritis and pyometra, which follow the neglected cases of retained placenta.

Prolapse of the uterus : This condition also affects a number of good, regular breeding animals. In this condition the uterus gets displaced from its normal position, comes out through the vaginal canal and hangs outside.

Main cause for this condition is debility of the animal. The uterus may get displaced following strong uterine contractions necessary to cause ex-

(*Contd. on page 24*)

GREAT MEN SPEAK

We must always listen to criticism of our faults and failings never to our praises.

Mahatma Gandhi

God is one. He is ever Changeless and Formless. We are His mirrors. If we are straight and pure, God is also reflected in us as such. But if we are crooked and vile, His image suffers the same distortion. It behoves us, therefore, always to remain clean and pure in every respect.

Mahatma Gandhi

He alone knows the charm of solitude who has deliberately taken to it.

Mahatma Gandhi

He who is the dust of everybody's feet is near to God.

Mahatma Gandhi

Life is not for making merry. Rather it is for the realisation of God and for the service of humanity.

Mahatma Gandhi

A man of the world can as little comprehend the universe as a fish living in the ocean can fathom its depths.

Mahatma Gandhi

Truth can be found by searching within, never through argument or disputation. It is just the same if for 'Truth one reads 'God'.

Mahatma Gandhi

If God resides in every heart, then who dare hate whom ?

Mahatma Gandhi

The darkness of egoism is more impenetrable than darkness itself.

Mahatma Gandhi

Our body has been given to us on the understanding that we should render devoted service to God with its aid. It is our duty to keep it pure and unstained from within as well as from without, so as to render it back to the Giver when the time comes for it, in the state of purity in which we got it.

The relation between the body and the mind is so intimate that, if either of them got out of order, the whole system would suffer. Hence it follows that a pure character is the foundation of health in the real sense of the term; and we may say that all evil thoughts and evil passions are but different forms of disease.

Perfect health can be attained only by living in obedience to the laws of God, and defying the power of Satan. True happiness is impossible without true health and true health is impossible without a rigid control of the palate. All the other senses will automatically come under control when the palate has been brought under control. And he who has conquered his senses has really conquered the whole world, and he becomes a part of God.

Mahatma Gandhi

All fear and anxiety is the result of desires; headaches and heartaches are the consequence of desires. You cringe and sneak before the President or King, because you desire his good grace. You become the Lord of Lords, the King of Kings when you are free of desires, when one by one these desires are thrown off. How free and happy you become that moment ! Thus Rama says that the path of Truth is not a thing to be accomplished or brought about, your exertions and efforts are that you will have to undo simply the bondage and thraldom which you have already done through your desires.

Swami Rama Tirtha

In the first attempts, in the religious direction, the devotee, the worshipper, looks upon God as away from him, as invisible, and he speaks of God in the third person, as if he were absent, "I am His". This is the beginning of religion, it is like mother's milk to every child of religion. Without having once fed upon this milk, a man is incapable of making further progress in religion, "I am his". Is it not sweet when a man realises even this perfectly; awakes early in the morning and thinks, "My master wakes me", goes to his official duties and looks upon those duties as imposed upon him by his dear, sweet master, God; Looks upon the whole world as God's and regards his house, his relatives, his friends as God's, as vouchsafed unto him by God ? Oh, is not the world turned into a veritable Heaven, is not the world converted into a Paradise ? Let the man be sincere, let him earnestly and with his whole heart feel and realize that

everything about him is his Master's, his God's, and this body is His. When realized perfectly even this idea brings exquisite joy, indiscribable Happiness, supreme bliss—it is sublime. This is sweet enough when realised and put into practice, but as a creed it is only the beginning.

Swami Rama Tirtha

People who believe in religion as an experience of truth, as an encounter of the Reality, will never quarrel about the names which they give to God. They will never quarrel about the approaches by which one gets to God. They will tell you that God is there in your inmost heart; He is the secret of your being; He is the Lord of your inner chamber There He is if you have the perception to see that He dwells there, hidden. Because we have so many other interests in life, He is there unrecognized. If you are able to unveil the secret, you see Him face to face. It is not a question of your trying to get at God. not a question of your having an idea; but the idea must have you, God must take hold of you, possess you, make you a different being altogether.

Dr. Radha Krishnan

Each man will have to pass through this great conflict as in the *Arjuna Visada Yoga*. No man who does not doubt or despair is truly alive. It was Jesus who said "My God, My God why has thou forsaken me ? It is Draupadi who cried out when she was in great distress : "I do not have my husband here. Not even You, O God : you have all deserted me. I stand alone in the nakedness of my loneliness, of my utter dependence." It is at that moment that the Supreme takes hold of you, takes you out and fashions your nature.

Dr. Radha Krishnan

Each soul is potentially divine.

The Goal is to manifest this divinity within, by controlling nature, external and internal.

Do this either by work, or worship, or physic control, or philosophy by one, or more, or all of these and be free.

This is the whole of religion. Doctrines or dogmas, or rituals, or books, or temples, or forms, are but secondary details.

Swami Vivekananda

Good and evil are inextricably combined and one cannot be had without the other. The sum total of energy in this universe is like a lake, every wave inevitably leads to a corresponding depression. The sum total is absolutely the same; so as to make one man happy is to make another unhappy. External happiness is material and the supply is fixed; so that not one grain can be had by one person without taking from another. Only bliss beyond the material world can be had without loss to any. Material happiness is but a transformation of material sorrow.

Swami Vivekananda

"Do not blame any other but thy own past deeds. I am reaping what I sowed, so why blame another ?"

Guru Nanak Dev

The mind, no doubt, is restless and hard to curb, but it can be subdued by constant practice or detachment from worldly things."

Geeta

We labour to bring about a welfare State in India. In countries where such a State has been established in so far as the material things of life are concerned, we see patterns of behaviour which shock the older generation. There is growing juvenile delinquency and a rejection of all set patterns and even of basic national cultures. While on the one side we see tremendous advance, on the other we notice a disintegration of society, because of cement of moral and ethical standards and patterns of behaviour gradually melts away. In any event, we cannot stop or reverse the current of change which science and technology have brought about in great parts of the world. The question for us to consider is whether we can retain in this process some of the basic values to which humanity has attached great importance in the past, and whether the spiritual element in life, using the word in its widest sense, can be retained or augmented or whether it will fade away. Without that spiritual element, probably the disintegration of society will proceed inspite of all material advance.

Jawaharlal Nehru

Our scientific world is our world of reasoning. It has its greatness and attractions. We are ready to pay the homage due to it. But when it claims to have discovered the real world for us and laughs at the worlds of all simple minded men, then we must say it is like a general grown intoxicated with his power, usurping the throne of his king. For the reality of the world belongs to the personality of man and not to reasoning, which useful and great though it be, is not the man himself.

Rabindernath Tagore

(*Contd. On Page 20*)

Application of Dry Farming Techniques for Successful Crop Production in India

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About 61 per cent of arid and 13 per cent of semi-arid land of country is in Rajasthan. The average annual rainfall (31.7 cm.) of the state in general and of the districts—Barmer (26.3 cm.), Bikaner (29.1 cm.), Churu (17.9 cm.), Ganganagar (25.9 cm.), Jaisalmer (17.9 cm.), Jalore (35.5 cm.), Jhunjhunu (40.0 cm.) Jodhpur (24.0 cm.), Nagaur (31.9 cm.) and Pali (39.0 cm.) in particular is less than 40 cm. 85 to 96 per cent of this amount is received from July to September. Therefore, successful crop production in the state is not possible without adopting dry farming practices. Dry farming is the system of producing crops under conditions of low and uncertain rainfall through efficient management and utilization of rain water. In areas where there is facility of even a few irrigations between long dry spell of two consecutive rains, dry farming can be very successful. The practices which will help catching rain water so that there is no run-off, holding most part of rain in soil and preserving it for efficient utilization, should be adopted for successful crop production.

Mechanical measures like bunding and tillage have been associated with agronomical practices like manuring, crop rotation, strip cropping, fallowing, and use of drought resistant varieties only with a limited success. Therefore, land development followed by mechanical measures in the authors' opinion need further clarification for their correct application in dry farming. Any area which is to be brought under dry farming should be first fenced and no grazing should be allowed. If general slope within the area is less than 2 per cent and soil is sandy, contour bunding may be done, provided field is uniformly graded in the direction of slope. If too many high and low spots are there, levelling between two bunds would be necessary.

Contour bunding followed by contour cultivation (without levelling operation between two bunds) may be practiced to a great success. Contour cultivation is the tillage operation on contour lines so as to make small bunds or water obstacles or minibarries perpendicular to the direction of flow of water. In these small but large in number barries, rainfall receives maximum opportunity for infiltration, thus increasing soil moisture uniformity over entire land while reducing the erosion hazard. Barriers formed by contour cultivation in sandy soils are very small and are generally washed away in the very first rain. It would be desirable to have some bigger size barrier (a ridge 25 cm. high formed by a bund former) at closer spacing so that even if there is a shower of high intensity lasting even an hour or more the barrier should not be washed away. Such ridges formed at closer spacings (4 m.) will retain water to be absorbed in soil without runoff and can be made very conveniently and economically without much of levelling operation.

The areas where land slope is uniform, regular and does not need much of cutting and filling to clear of high and low spots, land may be graded and smoothed. It is defiined as the process modifying surface relief depressions to a plain land surface to allow uniform absorption of available rain water in the soil profile. Land smoothing here refers to clearing of little basis or artificial storage pits on the surface. A smoother surface, whether graded or level, helps provide uniform water spreading over entire area. Grade or length of slope should be in conformity with the soil type and expected runoff, otherwise high water velocities may cause soil erosion. On lands where slope exceeds 5 to 6 per cent and soil depth is a limiting factor, outwardly gentle sloping terraces may prove feasible for moisture conservation.

Proper tillage operations should be carried out to the benefit of crop in dry areas. Objective of

tillage as specifically applied to dry land agriculture is the mechanical manipulation of soil to provide conditions affecting weed control, more infiltration and aeration suited to crop growth by increasing the catching, holding and moisture preserving qualities of soil. Some latest concepts like zone tillage, mulch tillage and minimum tillage have a great promise in moisture conservation in arid and semi-arid zones.

We are not only faced with the moisture conservation in dry areas but also with water and wind erosion problems alike. Problems of water erosion can be solved by the above practices if properly done and managed. Wind erosion which is a very serious problem in arid and semi-arid zones should be tackled by wind erosion control measures. These measures are fundamentally the reduction of surface wind velocity and modification of surface characteristics other than vegetative methods like cultivated crops, shrubs and treats field and contour strip cropping. Tillage practices to produce rough and cloddy, surface, ridges normal to direction of prevailing wind, wind breaks, brush fences board walls are common. The practice of surface stubble mulch tillage is very effective in wind erosion control.

If sufficient catchment area is available and some runoff is expected; ponds can be constructed. Ponds are essentially surface storage depressions whether dug or natural to store excess runoff for crop production and animal or human use during off monsoon period or otherwise when required. Depending upon soil, vegetation and rainfall characteristics, certain volume of runoff is expected for land even in dry zones. Although all efforts are made by providing agronomical and mechanical systems of water absorption and permeation in the ground, one is sure to get 10 to 25 per cent runoff even in most of the aridzones of India. It is, therefore, very necessary to catch and impound this quantity for future use. Both the embankment and dugout type ponds may be successfully used in dry zones. Converting naturally available depressions in storage reservoir may prove more economical especially in dry tracts. To store water against deep percolation and surface evaporation is a problem. It is unfortunately frequent that soils do not favour water holding at places where bund construction is desired. Under the circumctances i.e. where more impervious soil layer is not availble incorporation and final compaction of well graded material (about 60 to 75 per cent well graded sand, 20% clay and remaining well graded silt) is beneficial. Use of bentonite, with minimum of 10 to 15 per cent sand as sealing material may be successfully made. Polyphosphate (a defloculating agent) and plastic films may be used as reservior liners. Pre-fabricated asphalt planks are also used. To check. surface evaporation plastic styrofoam rafts, and monolayers (long chain alcohal) may be used. Since, heavy earthwork and expenditure is involved in construction of these structures, it is always a good practice to follow a scientific design and maintenance procedure to obtain good results. To illustrate the dry farming practices an area on the Agronomy Farm of College of Agriculture, Jobner was undertaken and developed.

Development of the field for Dry Farming

An area which is on the Agronomy Farm, College of Agriculture, Jobner has no irrigation facilities. In *kharif*, only crops like bajra, cowpea, moong, guwar are sown. Average rainfall of this place is only 50 cm annually. This rain is very uncertain and sometimes very untimely. Soil is sandy (85 to 90% Sand), water holding capacity poor and infiltration very high. Crops in kharif often fail due to long dry spells between two consecutive rains. In rabi often no crop is sown due to lack of irrigation facilities. It was therefore, necessary to make provision to catch, store and preserve rain water so that in kharif crops can be grown successfully and soil moisture can be made available in rabi for growing drought resistance crops without fail even in absence of irrigation.

There are various practices discussed above for conserving moisture such as levelling and grading, terracing, bunding contour ridging, tillage operations etc. Each practice has its own merits and demerits. With a view to develop the field for dry farming, it was divided in following areas depending upon contour characteristics.

i) Area for strip cropping.
   a) contour strip cropping.
   b) field strip cropping.

ii) Area for grading and levelling.

iii) Area in which bunds were made with a tractor drawn bund former along the contour line with little deviation where necessary to keep the strip of almost constant width.

(*Contd. on page 25*)

Non-Chemical Control of Plant Diseases in India

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Plant diseases are one of the greatest hazards in man's continued struggle to feed and clothe himself. A food deficient country like India must aim at maximum total production. Violent fluctuations in production are caused by the destructive effects of epiphytotics control of plant diseases can be obtained by the use of plant protection chemicals. Nowadays a shortage in production of chemical protectants in India, is felt. Cultural practices adopted in the normal course of crop production may be changed to suit the control of plant diseases. This may reduce the cost of cultivation of each crop and the chemical can be saved and used in most appropriate cases.

Man can till the soil, add fertilizer and water, rotate his crops and practice crop sanitation which will protect crops from the attack of pathogenic organisms. All these efforts to provide satisfactory conditions for the growth of crop plants and protect them from pathogens constitute cultural practices. The cultural practices that have been useful in plant disease control are discussed.

Tillage

Prompt ploughing soon after the harvesting of a crop is beneficial from the disease stand point, to facilitate delay of the crop residue on which many pathogens are dependent. Deep ploughing effectively reduces the quantity of inoculum (diseased tubers) in the case of late blight of potato. Deep planting often favours damping off and other soil-borne fungus diseases by lengthening the susceptible seedling stage. Shallow planting of potatoes results in less damage from *Rhizoctonia solania.* Regular cultivation aids in keeping weeds in check, many of which might be hosts to vectors of plant pathogens. *Oxalis* spp., the alternate weed host of *Puccinia sorghi* attacking corn is controlled to reduce the quantity of inoculum.

Selection of clean disease free seeds and seed materials

It is better to use originally clean seed than separating uninfested seeds from infested lots as selecting or cleaning seed has its value, not only as regards disease but also in order to avoid other seed-transmitted defects. Cleaning seed wheat by fanning to blow out the light smut balls is a necessary preliminary to seed treatment in the case of bunt and is useful in the control of scab and other wheat diseases. Cleaning by floatation after delinting is a standard practice in removing infected seed from cotton and in separating ergot sclerotia or nematode galls from rye and wheat seed. Tubers infected with bacterial ring rot may be removed from seed potatoes by hand culling in a dark room under ultra-violet light, and hand selection to reject any obviously defective or infective propagating material.

The infected seeds and seed materials are the primary sources of infection. Diseases like sesame leaf spot and foot rot of paddy, grain and loose smuts of sorghum, anthracnose of beans, bunt, flag smut and loose smut of wheat, bacterial blight of rice, black arm of cotton, cowpea mosaic, pea mosaic, black gram leaf crinckle, tobacco ring spot, soyabean mosaic etc., are transmitted through true seeds. Virus diseases of potato, fruit trees, "Katte" disease of cardamom, bunchy top of banana, cassava mosaic of tapioca, sugarcane mosaic, black scurf of potato, bacterial ring of potato, foot rot of ginger, red rot and smut of sugarcane, wilt of betelvine are all transmitted through tubers, setts, grafts and budwoods. Selection of disease free seeds and seed materials before sowing or planting helps to give a good start for crop growth. Tuber indexing in potato has been used for obtaining disease free seed and for protecting the crop from virus attack.

Obtaining seeds from disease free localities

Seeds and seed materials have to be obtained from disease free areas. Southern States of India get their potato seed tubers from Simla for the control of virus diseases and bacterial ring disease. Farmers in southern parts of Gujarat import ginger, seed-rhizomes from the northern parts of Gujarat where the crop is free from foot rot disease.

Removing the body or reproductive parts of the pathogen

In a few instances, where the pathogen is large

and conspicuous and the value of the host is considerable, a limited control value attaches to removal of the pathogen or its reproductive parts by hand. This applies in the removal of cedarapple rust galls from ornamental cedars, leafy mistletoe. Corn smut deserves more attention in this connection as also *Danoderma* wilt of coconut.

Adjustment of sowing or planting date

Timing of sowing or planting may sometimes be helpful by avoiding periods particularly favourable for a pathogen. Late planted wheat crop exposes itself less to infection by rust than wheat crop planted on normal dates. Early and late sown crops have been found to be free from Oodhubatti disease of rice. For the control of leaf rust of sugarcane and blast of ragi the crops are planted during September-October instead of in June-July and thus they escape from the disease attack. Late sowing of cotton saves the crop from black arm disease. Late sowing reduces intensity of dry root rot infection in groundnut. Adjustment of sowing time of potato avoids optimum temperature of soil for the black scurf fungus. Adjusting sowing time to evade the insect vector incidence is suggested for the control of tobacco leaf curl. Early sowing is recommended for the control of tikka leaf spot of groundnut. Adjustment of sowing time has been found to avoid the rosette disease of groundnut. Avoiding cool and cloudy days for planting will help to reduce red rot of sugarcane. Delaying the planting of winter wheat while nearby fields of spring wheat are still green (and possibly wheat streak infected) is another way of keeping the virus inoculum down to a low level.

Seed rate and spacing

Closer spacing generally increases the diseases caused by fungi. Overcrowdling of seedlings in the nursery often leads to high mortality of vegetable and forest tree seedlings by damping off diseases. Reduced seed rate is recommended for the control of damping off diseases. Adoption of wider spacing helps to reduce the incidence of redgram wilt as the disease spreads through root contact. Wider spacing reduces infection by powdery mildew fungus on tobacco because of more sunlight and low humidity near foliage. Wider spacing reduces incidence of cotton anthracnose. Over planting to obtain thick stands has been recommended as a means of reducing damage from bacterial wilt of sweet corn caused by *Xanthomonas stewartii*. Closer spacing of 15 cm x 15 cm reduced the incidence of disease in percentage and increasing the yield in contrast to a wider spacing of 30 cm x 30 cm.

Selection of disease free areas for seed multiplication

Disease free seeds and seed materials may be grown in areas known to be free from such diseases. Coffee can be grown in western Hemisphere usually free from coffee rust which causes heavy losses in Eastern Hemisphere. In India, the potato diseases like bacterial ring and virus diseases have been effectively controlled by planting seed potatoes obtained from Simia where the seed remains free from such infections. By growing seed materials in places where the population of vectors is very low, potato virus diseases can be avoided. Seed potato is grown in Scotland where the population of the aphid vector (*Myzus persicae*) is low.

Avoididg use of infected manure

This is an important source of soil infestation in the cases of corn smut, brown spot of corn, potato scab and cereal downy mildew.

Regulation of fertility level and balance

Most fertile soils eventually require the application of fertilizer even when managed in accordance with the best tillage and rotation practices. Long sequence of crops removes large quantities of nutrient elements from the soil. The most commonly deficient element is nitrogen. The cereal crops, cotton, vegetables, forage crops and indeed, most economic plants show signs of distress when grown in soil with insufficient nitrogen for normal metabolism. Various degrees of chlorosis are first symptoms, which may be followed by blighting or burning, cessation of growth, and premature senescence. When phosphorus is lacking, stunting, foliage discolouration, die-back may occur. Cotton, corn, stone and pome fruits, and vegetable crops commonly show signs of phosphorus hunger when grown in soils deficient in this clement. Potash symptoms includes various types of chlorosis, leaf distortion, and irregular necrosis. Cotton, tobacco, grapes and vegetables all react rather quickly when grown in soils deficient in available potassium. To recover from deficiency diseases, necessary nutrients in the form of fertilizers have to be provided. The practice of turning under green manure crops has the object of adding significant quantities of organic material to agricultural soils to improve their physical condition and to supply

important quantities of plant nutrients in soluble forms. Application of organic manures and green manuring reduces the incidence of *Fusarium* wilt in redgram. Application of farm yard manure at the rate of 42 tons per acre has been found to control the wilt disease of cotton in the later stages of the crop.

Acute disease development sometimes arises from a disproportionate amount of one or more major mineral elements. Maintenance of tea bushes in vigorous growing condition is suggested as the red rust disease occurs more on unhealthy or less vigorous bushes. In general application of heavy doses of nitrogenous fertilizers has been found to increase the susceptibility of rice to blast, tobacco to powdery mildew, apple to fire blight and wheat to rust diseases. When the plants are recovering from stem rot disease of rice, it has been advised to apply nitrogenous fertilizers like ammonium sulphate to check the spread of the disease. Application of superphosphate to soil appears to increase the resistance of tobacco crop to leaf curl virus. Application of potassium reduces the infection of black arm and wilt of cotton and stem rot of rice.

Correction of deficiencies in trace elements

The correction of mineral deficiencies is an important control measure. On some soils where boron deficiency is likely to prevail, borax is commonly added before planting. Copper deficiency is corrected by adding copper sulphate to fertilizers. If a copper fungicide has been applied to the previous crop, there probably is enough copper available for the current crop. Plants are sprayed with manganese sulphate to correct manganese chlorosis. Magnesium deficiency is corrected by the application of magnesium sulphate. Zinc deficiency in citrus is corrected by the addition of zinc sulphate to the soil or it may be applied by incorporation in a spray mixture. Iron-deficiency chlorosis is corrected by spraying with ferrous sulphate solutions.

Soil amendment

Soil amendment is a large element in disease control, in the case of dry land foot rot of wheat, in which weathered or undernourished plants are most subject to disease. Specific soil amendment practices are indicated in the case of cotton wilt (potassium) potato scab (sulphur), club root of Crucifers (lime) and bacterial spot of stone fruits (nitrogen).

Adjustment of soil reaction

This method consists of application of lime or sulphur to change the pH of the soil which is favourable for the growth of pathogen. Good control of club root of cabbage is obtained by the application of 550 kg of lime per acre and control of powdery scab of potatoes is by applying sulphur at the rate of 410 kg/acre. Attack of root rot of tobacco (*Macrophomina phaseoli*) was overcome by application of 1000 to 2000 kg of lime per acre to the soil. As the brown rot bacterium in potato cannot thrive in two pH, application of sulphur at the rate of 135 kg/acre reduce the ph of soil and then liming the soil at the rate of 1000 kg/ha to to correct excess acidity is recommended. In South Kanaraapplication of lime is recommended for the control of stem rot of rice. Application of sulphur to the soil to change the reaction to pH 5 or lower practically eliminates losses due to sweet potato soil rot (*Streptomyces ipomoea*).

Method of cultivation

The incidence of onion smut has been largely prevented by changing the method of cultivation. Adaptation of transplanting seedlings instead of seedling helps the plants to escape from the disease. On the other hand "Katte" disease of cardamom has been successfully controlled by raising the crop by seedlings instead of through rhizomes. This is done because the virus is transmitted through rhizomes and not through true seeds. Sugarcane crops infected with red rot and smut should not be allowed for ratooning as the underground parts left over, harbour the pathogens.

Mixed cropping

Intercropping with an immune host checks the spread of the disease as the susceptible main crop will not be available continuously. Inter-cropping of redgram with sorghum reduces incidence of redgram wilt. Inter-cropping of cotton with sorghum and dew gram (*Phaseolus aconitifolius*) results in low incidence of cotton root rot. Intercropping sorghum and phaseolus in a crop of clusterbean reduced the incidence of wilt and root rot of cluster beans. Growing pulses as a mixed crop with cereals like bajra or sorghum reduced the incidence of blight of pulses (*Phyllosticta phaseolina*).

Leguminous crops planted with rubber trees produces root barriers in the soil which retard the growth of rhizomorphic strands of the mycelium of *Fomes lignosus* causing root rot of rubber. Occa-

sionally cover crops are used as catch crops, which become heavily infested because of their complete susceptibility to organisms such as nematodes. Subsequent deep ploughing tends to reduce the damage by the pathogens to the following crops.

Irrigation and drainage

Generally soil-borne pathogens spread from one field to another through irrigation water. Therefore, irrigation should not be done through diseased fields. Excess irrigation should be avoided in the case of black shank of tobacco and dry root rot of citrus (*Fusarium* sp. *Rhizoctonia* sp. and *Diplodia natalensis*). The incidence of wheat rust and root-knot nematode attack can be minimised by judicious application of water. High pressure water spraying may aid in the control of diseases due to superficial organisms like powdery mildew.

Improved soil drainage is helpful in the control of root rots of cereals and vegetable crops, stem rot of rice, *Cephalosporium* wilt and brown spot (*Cercospora langipes*) of sugarcane, dry root rot and gummosis of citrus and fruit rot of ginger (*Pythium myriotylum*). Raising seedlings of vegetables in raised seed beds helps in the control of damping off diseases.

Trenching

Trenching between rows of orchard trees arrested the growth of Texax root rot organism (*Phymatotrichum amnivorum*) through soil. In India, this method has been successfully used for the control of citrus die-back. *Ganoderma* wilt affected coconut aud arecanut trees are isolated by digging trenches all round to prevent the spread of the disease.

High budding

High budding is a mechanical method of avoiding infection and followed for the control of citrus gummosis. In low budded plants bud point is very close to soil and become very easily diseased. In high budding the distance between bud point and soil is lengthened. Staking of lowermost branches arising close to soil helps for the control of soft rot of citrus and fruit rot of chikoo.

Crop rotation and fallowing

Soil pathogens, which can attack plants of one or a few species or even families, can sometimes be eliminated from the soil by planting for three or four years, crops belonging to species or families not attacked by the pathogen. Monoculture usually results in increased incidence of plant disease and steady reduction in yields. When a single plant species is seeded year after year, soil inhabiting pathogens may increase to the point at which economic production is no longer possible. Examples of such diseases include Panama wilt of banana, wilt of flax, common scab of potatoes, *Sclerotinia* rot of sunflower and root rot of cotton. The pathogens may persist from one to ten years or longer in the absence of principal economic host. Non-soil inhabiting pathogens, such as those causing some smuts of cereals, late blight of potato, leaf spot of banana and virus diseases of many economic crops are usually more destructive when single cropping is practised. This may be due to increasing quantities of over-wintering inoculum, repeated infection of economic hosts, or weed hosts whichserve as natural reservoirs for the pathogen and the increase of insect-vector population. In a rotation taxonomically unrelated species are introduced to prevent the incidence of inoculum and to interrupt disease cycles and thus reduce losses from plant diseases. Crop rotation is useful in the control of wilt of redgram, downy mildew of bajra, brown rot of potato, vein-clearing of bhendi, anthracnoses of cotton and cucurbits and tikka leaf spot of groundnut. A three or four year rotation with paddy or sugarcane is recommended for the control of Panama wilt of banana. For the control of brown rot of potatoes crop rotation eliminating potato and other solanceous hosts should be followed. A three year crop rotation including chilli is followed for the control of brown rape on tobacco. Chilli crop stimulates the germination of the parasite seeds in the soil without itself being parasitised. Among bacterial diseases, bacterial wilt of tomato and many other plants caused by *Pseudomonas solanacearum* is difficult to control when the pathogen becomes well established in the soil. Three year rotation with maize, soyabean and red top grass when used in conjunction with other measures can be adopted for its control. Four or five years should intervene between crops of tomatoes where bacterial wilt has been prevalent. Dry fallow is of value when there is need to conserve moisture, to control weeds and to permit soil-borne pathogens to die ont. Water fallowing for one growing season has been reported to control *Sclerotinia* spp. and water fallowing for one to three years has been practiced successfully in the control of *Fusarium* wilt of banana. Fallowing has been effective in the control of take-all disease of wheat and *Cercosporella herpotrichoides*, a root

Effect of Nitrogen, Phosphorus and Potassium Fertilization on Grain Yield and Phosphorus Content of Gram (Cicer arietinum Linn.)

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Introduction

Gram (*Cicer arietinum L.*) is an important pulse crop in India. It is largely consumed in the form of a pulse ('dal') while its tender green grains constitute a very favourite vegetable.

Optimum fertilizer application is one of the well established methods for increasing crop production, The information on the fertilizer requirement of gram crop is limited inspite of its importance. The present studies were, therefore, initiated to know the effect of N, P and K fertilization on the yield of gram. Maximum response dose, optimum dose and economics of fertilization have also been worked out.

Materials and Methods

A field experiment was conducted on a loamy sand soil at the Punjab Agricultural University Farm, Ludhiana during Rabi 1974-75. The soil tests indicated pH 8.5, E. C. 0.10 mmhos/cm and O. C. 0.20%. Available N, P and K were 100, 12 and 120 kg/ha respectively. Selected combinations of five levels each of N, P and K were tried in an 8A4 design as proposed by Cochran and Cox (1950). The N, P and K were supplied through urea, triple superphosphate and muriate of potash, respectively. The seeds of G-130 gram were sown after drilling the above fertilizers.

The grain yield was recorded. The grains were analysed for total phosphorus content following vanado-molybdo-phosphoric acid method (Jackson, 1967).

Results and Discussion

Application of N ond K was found to have no significant effect on the gram yield. Application of phosphorus increased the grain yield (Table 1). The application of 15.5 kg. P_2O_5 per hectare gave 82 per cent more yield than no phosphorus treatment. The maximum response dose calculated from the quadratic regression equation (Fig. 1) was 32.82 kg P_2O_5 per hectare whereas the optimum dose was 31.4 kg P_2O_5/ha.

Gram being a leguminous crop can fix free N through symbiotic bacteria. Nitrogen already present in the soil might, therefore, had been sufficient as starter dose for symbiotic bacteria and thus applied N gave no beneficial effect on grain yield. Our results with P application are similar to those reported by Kachroo (1970) who inferred that in West Bengal only P application increased the yield considerably. The lack of response to K in this study might be due to the presence of illitic type of clay minerals (rich in potassium) in the soil. According to kanwar (1959) illite is a dominant mineral in the soils of Punjab.

The increased yield due to applied P may also be attributed to the enhanced uptake of P by gram (Fig. 1). In a four year trial at pusa, application of 54 kg. P_2O_5 per acre gave 45.8 per cent more yield than no fertilization (Kachroo, 1970). Khare and Rai (1968) had reported that in leguminous crops, P application increases N fixation considerably along with an increase in N content of the soil. The results of present study reveal that application of higher rates of phosphorus above 40 kg P_2O_5/ha affected the grain yield adversely. This decrease in yield was probably due to the imbalance in the soil created by higher P application.

The economics of fertilizer use was also worked out (Table 1) The application of 15.5 kg P_2O_5/ha gave maximum profit of Rs. 427/-per hectare.

The above results indicate that the application

of N and K has no effect on grain yield but applied P increases the yield and P content of grains. The optimum dose of fertilizer for grain is 31.4 kg P_2O_5/ha where as the maximum response dose is 32.82 kg P_2O_5/ha. With higher rates, gram yield may be affected adversely.

Table 1. Economics of fertilizer use on gram

Dose of P_2O_5 applied (kg/ha)	Notation according to design	Grain yield (kg/ha)	Additional yield over control (kg/ha)	Value of additional yield (Rs.)	Cost of fertilizer (Rs.)	Net profit (Rs.)
0	—1.633	1190	—	—	—	—
15.5	—1.000	1450	260	520	93	427
40.0	0.000	1400	210	420	240	180
64.5	+1.000	1130	—60	120	387	—507
80.0	+1.633	1200	10	20	480	—460

Prices per quintal taken are :—TSP (45% P_2O_5) =Rs. 270/- Gram =Rs. 200/-

Save Your Mustard From The Greedy Aphid

A choice of four methods in now available for dealing with aphids, the destructive pest of mustard.

They can be so greedy as to leave only a few handfuls of grains at harvest, if not checked on time. Experts, therefore, warn that any control measure to be effective should be taken up as soon as a few of them show up and not wait till they have multiplied in large numbers. Farmers quite often make the mistake of withholding any measure till the pest has really done some damage. Choose from these :

* Apply 4 kg of Thimet 10 G (phorate) or 8 kg of Disyston/Solvirex 5 G (Disulfoton per acre. The granules should be applied by broadcasting followed by light irrigation. They should never be applied with hand.
* Give two sprays with Sayfos 70 DP (Menazon) at 30-day intervals. Use 125 gm of the chemical per acre for the first spray and 250 gm for the next spray.
* Three sprays with Metasystox 25 EC or Rogor 30 EC or Thiodan 35EC. The dosages to be used are 250 ml per acre for the first spray, 350 ml. for the second one and 400 ml for the third. Instead, Dimcron 100 (Phosphamidon) at 60, 90 and 100 ml per acre can be sprayed at 20 days intervals.
* Five sprays with Malathion 50 EC at 10 days, intervals.

Out of these four treatments, application of granules has been found to give maximum return in experiments carried out by the Punjab Agricultural University, Ludhiana. But it may be noted that all the measures are equally effective. Farmers can utilize any one depending upon the availability and cost. (F. I. V.)

(*Contd. from page 12*)

Therefore, throngh all his questionings and imaginings from the dim down of his doubtings and debates, man has come to the truth, that there is one infinite centre to which all the personalities and therefore all the world of reality, are related. He is *Mahantam Purusham*," the one Supreme person; He is '*Satyam*, the one Supreme Reality. He is '*Sarvanubhuh*', He feels in him the feelings of all creatures, therefore he feels himself in all feelings.

But this Supreme person, the centre of all reality, is nol merely a passive, a negative receptive being, *Ananda-rupam amartam yad Vibbati.* He is the joy which reveals itself in forms. It is His will which ereates.

Will has its supreme response, not in the world of law, but in the world of freedom, not in the world of nature, but in the spiritual world.

Rabindera Tagore

Insecticides of Vegetable Origin

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Perhaps the insecticides of plant origin have been in use for the longest time in agriculture and public health but the quantity in which they are consumed has remained dismal low. Although the success of any insecticide would depend upon its toxicity, target specificity, short life and cheapness, the synthetic organic insecticides despite lacking some of these properties had a hey day and surpassed comsumption of insecticides of any other origin. Because of the potential hazards posed by a large majority of these chemicals to human and animal populations and development of insect strains highly tolerant or resistant to them by their consistant use, it would be prudent to prospect for botanical insecticides again which are relatively free from such constraints.

The number of plants and plant constituents which possess economically viable insecticides for commercial use are strictly limited. A list of such promising plants, active material, toxicity and pests controlled are given in Table 1.

TABLE I.

Plants bearing insecticidal property

Plant	Active Ingridient	LD_{50} (Oral) in rat	Pests controlled
1	2	3	4
Tobacco *Nicotiana rustica, N. tobacum*	Nicotine	50-60 mg/kg	Aphids, thrips, jassids, white flies, leaf miners and psyllids.
Chrysanthemum *Chrysanthemum cinerariaefolium*	Pyrithin I, II Cinerin I, II	200 mg/kg	Aphids. thrips, diamond back moth, painted bug, mustard saw fly, flea beetles, cabbage butterfly, red palm weevil, storage pests, mosquitoes and house flies.
Derris elliptica, D. robusta, D. malaccensis, D. trifoliata and *D. ferruginea, Lanchocarpus utilis* and *L. urucu*	Rotenone	50-75 mg/kg	Pests of vegetable crops.
Quassia *Quassia amara*	Quassin	546 mg/kg (rabbit)	Aphids
Aeschrion exceisa, Picrasma excelsa, P. javanica var. *nepalensis* Sweet flag	Neoquassin		Aphids
Acorus calamus, A. gramineus Sabadilla	Acorin	—	Storage pests
Schoenocaulon officinale (*Sabadilla officinarum, Asagraea officinalis, Veratrum sabadilla*)	Veratridine Cevadine	4,000 mg/kg	Bugs, leaf hoppers, houseflies and cockroaches
Hellebore *Veratrum album*	Germerine		Bugs and household pests

Ryania *Ryania speciosa* Vahl. (*R. pyrifera*) and other *Ryania* spp.	Ryanodine	750-1200 mg/kg	Lepidopterous pests
Pongamia pinnata (glabra)			Pepper scale
Anabasis aphylla	Anabasin		Sucking type of crop pests
Castor *Ricinus communis*	Recinin	—	Termites
Neem *Azadirachta indica*	Azadrichtin	—	Locusts and storage pests
Custard apple *Annona reticulata A. squamosa*	Anonaine		Aphids and human lice.

In addition to above plant species, there are many plants which have remained though obscure to scientists, yet their leaves, bark, stem, flowers, seeds or roots have been used on a limited scale locally by farmers without the insecticidal principles being known. They are Ak (*Calotropis* sp.), Dhatura (*Dhatura* alba, *D. stramonium*), Lantana (*Lantana camera*), soapnut (*Sapindus mukorossi*), encaleptus, cashew shells, tomato seeds, corolla of *Cassia* sp., *Poinciana* sp., *Coesalpinia* sp., *Callistephus* sp., *Jasminum* sp., *Tabebiua* sp., *Bongainvillea* sp., *Tridax* sp., *Luffa* sp., and *Barleria* sp., *Persian lilae, Melia azedarach* (leaf, fruit), *Croton tiglium* (seed), *Mundulea sericea* (bark), *Nicandra physalodes* (leaf) *Tephrosia vogelii, Delphinium* spp., *Pogostemon heyneanus* (leaves), *Saussurea lappa* (root), *Santalum album* (wood), *Cymbopogan nardus, Andropogan nardus, Cannabis sativa* (leaf), *Trigonella foenum—graecum* (leaves), *Vitex negundo* (leaves) etc. which seem to possess insecticidal properties.

The need for use of natural insecticides is to eliminate chemicals poisonous to man since they are easily biodegradable and more or less selective. Over the years, they have proved useful as killers of fish or human or animal parasites and destroyers of crop pests and withstood the natures test by not endangering ecological system. Production of synthetic pyrethroids prove the point that naturally occuring insecticides are much safer, effective and can replace chemicals poisonous to man and other non-target organsims. Some of the prominent botanical insecticides which are in commercial use are discussed here.

Pyrethroids : The insecticide is manufactured from the dried flowers of chrysanthemum plants belonging to the species *C. cineraviaefolium*. Cultivation of chrysanthemum in India is mostly concentrated in Jummu and Kashmir and attempts to increase acerage in the Punjab, U.P. and Tamil Nadu have not met with much success.

The pyrithrin content of India flowers is 0.5% to 1.41% and inspite of 79 tons of flower production in Kashmir valley, 200-300 tons of flowers from Kenya which have 1.43%—1.89% pyrithrins are imported every year to meet indigenous requirement of pyrethrum.

Pyrethrum acts as a contact poison and paralyze insects quickly causing death almost instantaneously. Since the residual effect of pyrithrine is short lived, it can be potentiated severalfold by adding synergists such as piperonyl butoxide, seasame or Karanj oil which are not toxic by themselves. Preparation of pyrithrin and piperonyl butoxide has been used in the past for the control of red palm weevil in coconut and storage pests. The maximum consumption of pyrethrum is for the manufacture of household sprays in combination with DDT, BHC, Lindane, Malathion etc. for the control of mosquitoes, flies, cockroaches, ants, crickets etc. Being ephemeral in nature, pyrethrum insecticides can be used for the control of pests of vegetable and fruit crops, particularly, at the time of harvest.

Synthetic pyrithrins named resmethrin and biopermethrin have been developed in U. K. as a substitute for DDT or dieldrin with more toxicity but less persistent action and mammalian toxicity. These may prove to be a good substitute for natural pyrithrins.

Nicotine : Tobacco plants which is the main source of nicotine and other alkacloids is cultivated all over India but more extensively in the South in Andhra Pradesh. The total area under the crop

is 8,96,000 acres and the yield is about 2,63,000 tons of dried leaves. Nicotine which is the principal toxic alkaloid is present upto 8% in *Nicotiana rustica* and 2% to 3.5% in *tabacum*. For a long time, home made preparation called tobacco soap decoction, prepared by boiling or soaking over night tobacco leaves, stalks etc. in water with soap has been used in India as a contact poison to control aphids, psyllids, scale insects and white flies. The commercial preparation is available as nicotine sulphate containing 40% nicotine. Addition of an alkaline activator such as soap or calcium caseinate helps to liberate nicotine in nicotine sulphate besides increasing the spreadibility of the insecticide.

Tobacco can also be dusted on vegetable crops in combination with kaolin, bentonite, gypsum, carbonates or hydrated lime. This acts as a stomach poison and therefore can be used with advantage in integrated pest control for it does not kill parasites and predators and also prevents rapid volatilizalion or degradation thus increasing residual property of nicotine.

Nicotine preparations do not leave residues for unduly long time nor do they cause phytotoxicity to foliage. It is highly toxic to insects, such as, aphids, thrips, white flies. jassids, leap miners, ants etc. and therefore can be gainfully employed in controlling them.

Annually India has 28,000 tons of tobacco waste costing approximately Rs. 2.0 crores which is not put to any use. There is need to utilise this insecticide despite its cost for reasons of absence of residue problem and phytotoxicity.

Rotenone : Derris roots containing rotenone has long been used as an insecticide. Plants belonging to the species *Derris* grow widely in Assam. *D. ferruginea* contains 3% rotenone and is not considered of any commercial value. Some experimental cultivation of *D. elliptica D maleccences* was started in Karnataka and Uttar Pradesh but no attempt has been made to utilise the roots.

Rotenone insecticide is invaluable for the control of caterpillars and beetles feeding upon leaves especially when toxic residues are not desired.

It is characterized by slow action both as contact and stomach poison as compared with pyrethrum and therefore can help to avoid hazards to vertebrates.

Quasin : The bark and wood of the tree *Quassia amara, Aeschrion excelsa* and *Picrasma* spp. contain insecticidal principle quasin or similar active ingridient. The chips are boiled in water and soft soap and the strained liquid sprayed. It acts as a contact poison and judged effective against aphids.

Acorin : The roots of the plant sweet (*Acorus calamus*) yields acorin glucocide. The plant grows wild in marshy areas of western ghat round about Nilgiri, Kashmir, Himachal Pradesh Manipur, Nagaland, Punjab and U. P. hills and regularly cultivated in Karatagere taluk in Karanataka State.

The insecticidal property of acorin has not been exploited fully though the farmers of Orissa mix the powdered root with foodgrains for protection against storage pests. The extract has also wide scope in perfumes and medicines.

The plant requires only low lying, water-logged marshy places, unfit for growing any other economic crop and since its cultivation does not demand any attention, efforts should be made to grow sweet flag in order to make up the deficiency of a suitable insecticide for use in the granary.

Veratridine, cevadine and germerine :

Sabadilla seeds or rhizome hellebore or entire plant when dried and powdered can be used as 20% dust formulation or applied as 1% decoction in water. It acts both as stomach and contact poison and have been found active against bugs, housefly, cockroaches, caterpillars, and beetles.

The effectiveness of these insecticides is not long lasting because they decompose rapidly on exposure to light and air. Because of lack of persistence the insecticide could not be used on field crops but has scope against household and storage pests.

Ryanodine : The powdered form of roots, stems and leaves of the plant *Ryania* sp. are used as dust or suspension which may contain 0.2% ryanodine alkaloid. It acts both as a contact and stomach poison and proved quite effective against caterpillars, cockrooches, mosquitoes etc. The residual life being short made its use uneconomical although there is advantage of treating food crops at the time of harvest with this insecticide.

Since ryania is an imported insecticide and twice as expensive as pyrethrin, it has not become popular in India.

Anabasin : The leaves and stem of *Anabasis aphylla* contains the toxic principle. The plant is indigenous to Russian Turkistan and neighbouring countries of Central Asia. This alkaloid is also present in tobacco and its insecticidal property is similar to nicotine and therefore can be used against sucking type of crop pests.

Ricinin : Castor plant contains ricinin in the seeds. Castor seed cake has insecticidal property against termites. It was used for long time in sugarcane fields in India before organic synthetic insecticides were introduced in the market.

Azadrichtin : Neem seed containing azadrichtin possess insecticidal property. Suspension of powdered seeds when sprayed on plants acts as repellent for desert locust. It is also systemic in action when applied to the roots. Due to lack of residual property it has no field use but azadrichtin has been claimed to be a good protectant of grains against storage pests.

Anonaine : Powdered dried seeds, leaves, bark and roots of custard apple exhibit insecticidal properties. The alkaloid has been identified as anonaine. The mode of action is both stomach and contact, the latter is equivalent to rotenone or nicotine and therefore effective against aphids.

Custard apple grows all over India. It grows wild in the rocky terrain of Madhya Pradesh and Andhra Pradesh and the fruits come in abundance during the months of October, November. The seeds can be collected, dried and powdered for being used against body pests such as lice or mixed with food grains for the control of storage pests.

Notwithstanding the fact that the organic synthetic insecticides are being used in pre and post harvest plant protection during the last three decades or so and most of the research work is also directed in finding their efficacy, uses etc., there is a vast scope for carrying out investigations on insecticidal plants to establish their property and to do exploratory work on their possibility of cultivation and manufacture on commercial scale. At present, only a small fraction (0.3%) of the total insecticides consumed in India is of plant origin. Attempts are being made from time to time by Indian Council of Agriculture Research, Forest Research Institute, Dehradun, Medicinal Plant Research Institute, Jammu Kashmir, Council of Scientific and Industrial Research and National Chemical Laboratory, Poona to conduct research on plants toxic to insects and cataloguethem. The investigation and development of the commercially well established plant insecticides should be given emphasis by various insecticide research centres in India to provide substitutes for synthetic organic insecticides which are receiving closer public scrutiny and condemnation.

(*Contd. from page 10*)

pulsion of the foetus. The condition is usually seen in old, debilitated animals participating in the breeding programme.

Another cause of the condition is a loosening of the attachments of the uterus to the surrounding organs. The uterus is thus enabled to get displaced and prolapsed through the vagina to the outside.

The condition is usually encountered immediately after a calving but can be seen in a pregnancy as well. In the latter case the foetus may be thrown out prematurely. Some animals show a persistent tendency for prolapse and this interferes with the planned breeding programme of the herd.

The animals having a prolapsed uterus suffer great physical discomfort, their walking gait is appreciably changed, milk yield is reduced or lost completely. The prolapsed organ gets swollen and if it is not attended to in good time, it may undergo necrosis and decomposition, increasing the distress to the animal.

Diagnosis of the case is very easy. The prolapsed part should be examined carefully to ensure that it is uterus, since in some animals a prolapse of the vagina may also take place and be confused with a prolapse of the uterus.

Assistance of a veterinarian should always be obtained in treating such a case. In the course of treatment, the prolapsed uterus shouid be washed and cleaned using a good antiseptic lotion. The part should then be held carefully between two hands and pushed slowly inside the vagina to its normal place. The fist is then moved inside the uterus to set it in its normal location.

Many a times the cows strain and try to push out the uterus again. This can be controlled physically as well as by administrations of tranquiliser drugs. This is further ensured by inserting—into the uterus—a long necked bottle, duly sterilized, holding it in place by fastening it to thin ropes, which are then tied round the hind parts of the animal. Other measures are taken by considering the actual cause.

Preventive measures are avoidance of debility in pregnant animals and of irritation to the uterus during and after a calving.

• The foregoing discussion highlights the fact that the uterus—the main reproductive organ is subject to many pathological conditions. All these conditions mar the breeding and production plans of a herd and cause a heavy economic loss to the animal owners. It is, therefore, imperative that all efforts are made to ensure a perpetual healthy status of the reproductive organs of the regular breeding namilchimals.

(*Contd. from page 14*)

Method of Development

There were two fields 'A' and 'B' Both the fields were surveyed and contour map was drawn at an interval of 1 meter in field 'A' and 0.5 meter in 'B'. A smaller interval was selected in 'B' since area had more undulations.

Area in field 'A' was divided in different plots to suit the different practices for moisture conservation. On one side of the field, practice of contour strip cropping was done at a contour interval of 0.3 m, while on the other side, field strip was followed. Width of each strip in contour strip cropping varied from 15 to 25 meters while width for field strip was a constant 15 meters. Since field had a general slope in south-west direction, field strips were easily made. Driver was instructed to take a constant width of 15 meters and make ridges with help of a tractor drawn disc type bund former. This implement was designed, fabricated and tested by the first author at college workshop. In the field where contour strip cropping was followed each line was to be pegged by field contouring method, which required lot of labour. Contour strip cropping had a special advantage since very little earth work (i.e. levelling) was necessary between two contour ridges to make the plot smooth and reduce the longitudinal slope zero. In field strip cropping more earth work was required.

In area where contour ridges were made (width between two contour ridges was kept 4 meters so that tractor can safely work between them), field had too many undulations. If contour strip or field strip cropping was followed, it would have required too much earth work even for smoothing operation, therefore, this practice was followed. This is nothing but field strip cropping where width of strip was only 4 meters. This practice required very little levelling between two ridges.

Some areas which had regular and smooth surface with very little undulations, were graded on existing slopes and cultivation practices were followed across the slope so that runoff in rainy season can easily be checked. Since, soil is very permeable runoff is practically neglegible (except a few times only in the season), moisture war uniformly distributed even in these plots.

In field 'B' almost entire field was practiced with contour ridging (field strip, 4 meter wide) except a portion which was covered by contour strips (4 to 5 m. wide). A small portion where field had a regular and smooth surface grading was done.

Crops :

This area was producing very little before introduction of above dry farming practices. The original field conditions are shown in Fig. 1. After introduction of these practices bajra and cowpea were shown in alternate strips in the area covered by contour strip cropping and, bajra and jowar in alternate strips in field strip cropping. Area covered by ridges was sown with bajra and some area with moong. In graded area guar was sown. In field 'B' portion in which 4 meter wide strips were made on contour, grasses Panicum-antidotale and cenchrus setegerus were sown. In rabi season of 1974, it was possible to grow *taramira* in these fields without irrigation while it was not possible to grow elsewhere without irrigation. A good harvest (bajra 12-15 q/ha, Guar, Moong, Cowpea 9-10 q/ha and taramira 8q/ha) was obtained in both the seasons.

Cost of operation :

For four meter wide strips made across the slope ridge making costed Rs. 60.00 per hectare. In these strips minor smoothing and levelling was necessary which costed furthur Rs. 60 to 80 per hectare. Thus total cost was Rs. 120/- to 140 per hectare.

For preparation of field for contour strip cropping, ridges were formed at an interval of 15 to 25 meters. It costed Rs. 15 to 25 per hectare, if contour lines are pegged in the field before hand. Levelling and smoothing cost was Rs. 135/- to 175/- per hectare. Thus, total cost of preparation was Rs. 150/- to 200/- per hectare.

In field strip cropping, where field strips were 15 meters wide, though ridge making costed very little (approximately Rs. 7 to 10 per hectare) levelling and smoothing cost was comparatively high (Rs. 200 to 250 per hectare) since ridges were not exactly on the contour line and there was always

some slope lengthwise which was to be removed so that there is no water flow along ridges.

Where there were many high and low spots and it was not possible to adopt above practices there was no alternative except knocking down high spots and filling the depressions. The land was graded in the direction of slope. Per cent slope being more, complete levelling was not possible, otherwise subsoil would be exposed. It costed from Rs. 250 to 400 per hectare depending on the size of plot and number of high and low spots. On boundary of the plot, ridge was made normal to direction of slope.

CONCLUSION

In Rajasthan, where water is a limiting factor in crop production and rainfall is very untimely and uncertain, efforts should be made to catch, store and preserve rainfall for successful crop production in *kharif*. Moisture received in *kharif* season may be carried over to *rabi* season by adoption of dry farming practices, so that crops like *taramira* and *sarson* can be grown even without irrigation and some other rabi crops may be grown with one or two light irrigations. For dry farming to be successful each field should be treated as an identity for use of different practices depending on soil type, rainfall, surface topography, soil depth and available implements. If construction of a pond is desired for storing excess runoff, whole catchment should be considered and care should be taken for its sealing to check percolation. Anti-evaporants should be used to check evaporation. With the experience gained by developing two areas for dry farming, it could be advocated that if proper measurers were taken for utilizing rain water even if in small amount, bajra, cowpea, gwar and moong in *kharif* season and taramira and sarson in *rabi* season can be successfully grown in Rajasthan.

(*Contd. from Page 18*)

rotting organism attacking cereals. Shallow planting immediately followed by flooding is practiced for the control of smuts of sorghum, bunt of wheat and flag smut of wheat.

Maintenance of sanitation

Many pathogens spend parts of their life cycles in soil, crop residues, weed hosts, or insect vectors. They may be transmitted by wind, water, insects, wastes of farm animals and by soil carried on agricultural implements. Therefore, it is often desirable to attempt to reduce the quantity of inoculum present through appropriate sanitary measures. General sanitary practices include the following.

(a) Disinfecting agricultural implements which might transport pathogenie organisms such as club root of cabbage and bacterial ring of potatoes, from one area to another. Wiping the tools with a disinfestant such as mercuric chloride, iodine, calcium hypochlorite, kerosene or formaldehyde solution may be desirable to avoid this and the grower should be aware of the danger in passing from infested fields to non-infested fields. The potato ring rot bacterium spreads from place to place in seed tubers but from tuber to tuber by handling practices. Viruses like tobacco mosaic virus and latent potato virus spread very readily by mechanical measures. Contaminated workers' hand serve as a continuous source of inoculum. Tobacco mosaic virus may be picked up from cigarettes or chewing tobacco. In these instances important sanitary measures consists in assuring that workmen keep hands decontaminated by frequent washings.

(b) Disinfecting pruning tools to prevent the spreading through orchards of such diseases as fire blight of pears.

(c) Destroying plant residues bearing pathogenic organisms by burning or burying them by ploughing immediately after harvest. Burying stone fruits affected by the brown rot organism (*Sclerotinia fructicola*), burning the stubbles of grain fields heavily infested with flag smut deep ploughing to bury infested refuse and destroying potato tubers infested with late blight are examples. Clean culture in apple orchard reduces the amount of inoculum of the scab organism in dead leaves by covering them with soil, but practice shows that it is only a part of essential control. Aphids often colonize in early spring on potato sprouts and so they have to be destroyed.

Handling practices

The handling practice which serves to control late-blight tuber rot is the delay in digging of the crop, if weather permits, until above-ground inoculum is reduced to a minimum and until the skin of the tubers below ground has matured to the maximum stage. The avoidance of bruising of

potatoes during harvest is important, because wounds are important avenues of infestation by tuber-rotting *Fusaria*.

Pre-storage curing of potatoes for about two weeks at about 21°C is recommended before they are placed in storage. It has been shown that pre-storage curing of sweet potatoes is necessary to stimulate rapid corking over of wounds to prevent infection by several of the pathogens which cause storage rots. Onion neck rot is an important storage decay in which infection takes place at harvest time. Penetration is facilitated by exposure of the succulent tissue when the top is removed at harvest. The percentage of infected bulbs will be reduced if the tops are allowed to mature thoroughly at the neck of the bulbs before the harvest operations are started. Precooling of fruits and vegetables before shipment is often practiced in order to check promptly incipient infection which might otherwise progress during the lag period required to reduce the temperature of a car load of produce icing the bunkers.

Local eradication

It refers to the activities of an individual grower, alone or with other growers who carries on eradication practices on his crop land or immediately adjacent areas. Such local eradication may be removal of barberries near wheat fields to aid in the control of crown rust. Eradication of cedar trees in the vicinity of apple orchards is effective in reducing damage from the cedar apple rust. Eradication of buck thorn (*Rhamnus* sp.) in the control of crown rust of oats, of *Thalictrum* sp. in controlling the leaf rust of wheat are helpful.

In special circumstances, an economic crop is locally eradicated. Fields of small grain may be burned because they are so badly infested with rusts, smuts or other diseases as to be completely economic; and citrus plantations may be eradicated after heavy attack by *Phytophthora* fruit rot. Banana attacks by wilt, coconuts by red rot, cacao by swollen shoot and witches broom, coffee by rust and rubber by leaf blight are other tree crops, which are locally eradicated. Local eradication of vegetable crops is made necessary by the heavy attack of plant pathogens such as the organisms causing cucumber wilt, lettuce drop, tomato wilt and late blight of potato.

Eradication of alternate hosts

For some of the rusts, the pathogens may have to infect alternate hosts to complete their life cycles. Stem rust of wheat with its alternate host of barberry (*Berberis vulgaris*) leaf rust of wheat with its alternate host of *Thalictrum* sp. crown rust of oats with its alternate host of Buck thorn (*Rhamnus* sp.), white pine blister rust with its alternate host of *Ribes* spp., corn rust with its alternate host of *Oxalis* spp. and apple rust with its alternate host of cedar or Junipers are best known examples showing the importance of the alternate host in the pathogen's life cycle. The alternate host can play one of the two roles in the disease cycle. In stem rusts of wheat, the pathogens can reproduce themselves and survive from one season to the next in the absence of alternate hosts. In other cases, the inoculum that attacks the economic host must come from the alternate hosts. Thus, complete control of the disease can be accomplished by completely eradicating the altrenate host.

Eradication of collateral host

When the host plant is an annual, and when the pathogen or virus does not over-winter (or over-summer) on debris or in the soil, wild perennial hosts often become the loci of over-wintering. Many of the downy mildew fungi over-winter as mycelium in the crowns of perennial weeds. The cucumber mosaic virus is carried over-winter in milk weed, poke weed and many other plants. The potato yellow dwarf virus and potato rugose mosaic virus (veinbanding virus) are carried over in *Physalis* spp. The yellow bean mosaic virus is carried over in sweet clover. Effective control of sugarcane mosaic was obtained by removal of maize, its collateral host from the neighbourhood. The cabbage mosaic viruses are carried over in Shepherds' purse and pepper grass. The yellow vein mosaic of bhendi is carried over in a wild host (*Hibiscus heterophyllus*). *Panicum repens*, *Brachiaria mutica*, *Digitaria marginata*, *Echinochloa crusgalli* etc., are the collateral hosts of rice blast fungus. *Cyanodon dactylon*, *Eleusine indica*, *Digitaria sangiunalis* etc., act as collateral hosts for sesame leaf spot fungus of rice. Successful control of fire blight of apples and pears has been obtained in New Zealand by compulsory removal of its collateral host, hauthorn bushes (*Crataegus* sp.). Destruction of volunteer cotton plants is essential in the control of black arm of cotton. All solanaceous plants should not be allowed to remain in the vicinity of tobacco crop for the control of tobacco mosaic. When the collateral hosts are eradicated economically, the cycle of the pathogen may be broken and the disease can be controlled.

Removal of diseased parts

Removal and destruction of diseased plant parts removes the main foci of infection and breaks the chain. Destruction of bud rot diseased nuts and leaf sheaths gives an effective protection against the onslaught of the disease in coconut. Fire blight of apple and pear caused by *Erwinia amylovora* can be controlled by pruning out infected branches as soon as they are observed. Fruit trees like almonds which have trunks or branches infected with the canker fungus, *Ceratocystis fimbriata*, can be saved by surgically removing the cankered area and applying to the exposed area lanolin impregnated with an organomercury fungicide to prevent reinfection. Witches broom of cacao, cedar apple rust black knot of *Prunus* spp., crown gall of small fruits are controlled by pruning out infected twigs and branches. Fungus or bacterial cankers of fruit trees, pink diseases of citrus, mango, sapota, guava etc., and many kinds of wood rots can be partially controlled by surgical practices designed to remove diseased tissues. The late blight causing fungus persists through infected tubers and refuse. Careful removal and destruction of such tubers by fire prevents the primary infection and dissemination of the disease.

In stem bleeding (*Ceratocystis paradoxa*) affected coconut and arecanut trees, the affected parts are scooped out by opening the stem and a little bit of healthy tissues is also removed. Then a burning torch is held to the cavity to sterilize the infected portion and then hot tar is smeared. The cavities have to be filled with saw dust or tar to prevent accumulation of water. In the case of anthracnose of banana, non-functional distal end of fruit stalks should be cut off after all hands are opened to prevent the diseased materials acting as sources for further spread. By pruning or cutting out the diseased plant parts other diseases like citrus, canker, downy mildew and anthracnose of grapevine, Loranthus in citrus, mango etc. are controlled.

Rogueing of diseased plants

Rogueing consists of completely removing or uprooting the diseased plants in early stages of the diseases to prevent their further spread. This method can be adopted for the control of smut of corn, millets and green ear of bajra and smut of sugarcane, *Orobanche* in tobacco, bacterial wilt of sweet corn, plant virus diseases including Katte disease of cardamom, sugarcane mosaic, groundnut rosette, cassava mosaic, virus diseases of potato and tomato etc. Individual diseased stone, pome and citrus fruit trees, elms infected with *Ceratostomella*, banana attacked by Panama wilt and bunchy top are rogued. Rogueing of volunteer plants of cotton is essential for the control of angular leaf spot of cotton. It is not widely useful in the control of epidemic diseases.

Resistant varieties

Breeding or selection of resistant varieties of a crop is perhaps the most powerful weapon against diseases. The resistant varieties available for each crop and for the important diseases are given in the Table.

Crop	Disease	Resistant varieties
Rice	Blast	Co. 4, Co. 25
	Brown leaf spot	BAM. 10, Co. 20, SR. 26-B
	Foot rot	Co. 18, Co. 22, ADT. 8, PTB. 7, GEB. 24.
	Stem rot	Basumati 3, Basumati 270.
Wheat	Stem rust, orange rust, yellow rust	Safed lerma, Simalika
	Loose smut	NP. 729, N.P. 791, NP. 823
Bengalgram	Physiological wilt	G. 24
Sugarcane	Red rot	Co. 846, Co. 449, Co. 1214, Co. 1261
	Smut	Co. 449, Co. 527
Cotton	Wilt	Jayadhar, Jarila, Vijay, Pratap, Verum.
Potato	Late blight	Kufri Kishan. Kufri Red, Kufri Neela.

(*Contd. from page 7*)

sidy is in addition to the price that the cultivator is able to obtain from the open market. The burden of the subsidy is borne by the industrial sector in U.S.A. The Indian industry has not yet developed to an extent that it can bear the burden of any subsidy for the agricultural sector. The point intended to be emphasised, however, is that it must be made sure that the cultivator does get a remunerative price for his produce as without that the agricultural sector can not develop at the required pace. There is a general complaint at present that the support and procurement prices fixed by the Government are not adequately remunerative.

विभिन्न कृषि रसायानों का मृदा अणु जीवाणओं एवं फसलों की उपज पर प्रभाव

विश्वम्भरनाथ तिवारी

वरिष्ठ भृदाअणुजैविकी सहायक मृदा एवं
कृषि रसायन विभाग
उ० प्र० कृषि विज्ञान संस्थान, कानपुर-२.

कृषकों ने फसल की पैदावार के लिए शुद्ध बीजों, रसायनिक उर्वरकों एवं उचित मात्रा एवं समय पर सिंचाई करने से जो उपज वृद्धि हासिल की वह सराहनीय रही है। परन्तु ये उपज बृद्धि एक हद तक सीमित हो रही है। इनके सीमित होने के कारणों में मुख्यतया प्राकृतिक प्रकोपों जैसे वर्षा आदि का समयानुसार न होने से प्रतिकूल वातावरण में विभिन्नता आ जाने से बिमारियों, एवं कीड़े-मकोड़ों का प्रकोप दिन-प्रतिदिन बढ़ने के कारण तथा कृषि रक्षा के सीमित साधन होने के कारण अधिक उपज देने वाली जातियों से भी अनुमानित उपज बृद्धि नहीं हासिल हो पाती है। आजकल फसल सुरक्षा हेतु विभिन्न प्रकार के कार्बनिक कृषि रसायनों का प्रयोग प्रचलित हो चला है। अतः इन कृषि रसायनों को किस मात्रा में, किस तरह से एवं किस समय प्रयोग करें कि अन्य साधनों एवं परिस्थितियों के सामान्य रहने पर अधिकाधिक उत्पादन प्राप्त हो सके। लेकिन इसके साथ-साथ यह भी देखना पड़ेगा कि इन विभिन्न कार्बनिक रसायनों का किस विधि से प्रयोग करें जो मृदा में उपस्थित विभिन्न प्रकार के अणुजीवाणुओं को भी कुप्रभावित न कर सकें। क्योंकि ये हमारी मृदा की भौतिक एवं रसायनिक गुणों को काफी हद तक प्रभावित करते हैं एव जटिल जीवाँश पदार्थों को सुलभ प्राप्य पदार्थों में परिवर्तित करते हैं जिन्हें पौधे आसानी से ग्रहण कर सकते हैं। मृदा में पाये जाने वाले शाकाणुओं, कवकानियों, काइयों, प्रोटो जोआओं, पूर्णजीवाणुओं आदि की क्रियाशीवता इनकी कमी एवं वाहुल्यता से मृदा उत्पादकता घटती एवं बढ़ती है। इन्हीं कारणों से इन जीवाणुओं का पौधों से जो मौलिक संबंध होता है उसका विशेष संबंध पोषण से ही होता है। विभिन्न कार्बनिक रसायनों का व्यएहार मृदा अणु जीवाणुओं एवं उपज बृद्धि पर किस रूप में होता है। इसकी चर्चा इस लेख में है।

फसल सुरक्षा की दृष्टिकोण से कार्बनिक कृषि रसायनों का प्रयोग मृदा अणुजैविज्ञों के अथक प्रयास के बाद निकाली हुई तकनीकी का विवरण नीचे प्रस्तुत किया जा रहा है साथ ही साथ यह ही बतलाया जा रहा है कि इनके प्रयोग से उपज बृद्धि एवं मृदा अणु जीवाणु किस हद तक प्रभावित होते

कुछ रोगों जैसे बीज जनित आदि का प्रभाव फसल पर अत्यन्त अदृश्य होने के नाते अनुमान लगाना संभव नहीं हो पाता है ऐसे रोगों की रोकथाम के लिए बीज बुवाई के समय ही बीज शोधन एवं भूमि शोधन के माध्यम से प्रयोग किया जाता है। जो रसायन प्रधानतया बीजशोधन एवं भूमि शोधन के लिए प्रयोग किये जाते हैं वे उदाहरणार्ण इस प्रकार हैं :— डी, डी. टी. बी. एच. सी., कैप्टान, थिरम, एग्रोसान जी. एन. सेरेसानड्राई सेरेसान वेट, ब्रेसिकाल, आरगैनोमरक्यूनाल, फोरेट, डाईसिस्टान, मैलाथियान, एवं राइजेक्टाल आदि। इन कृषि रसायनों की मात्राएँ विभिन्न फसलों के लिये भिन्न-भिन्न होती हैं। लेकिन दलहन में चना, मटर, उर्द एवं मूँग एवं सस्यों में जौ, गेहूं में जो भी निश्चित अनुपात निश्चित है को प्रयोग करने से यह पता चला है कि थिरम, ब्रेसिकाल, डी. डी. टी. एवं आरगैनोमरक्यूनाल आदि का अधिक दिनों तक प्रभावशाली बना रहने से फसल बीमारियों से सुरक्षित रहती है। फलतः उपज भी अच्छी मिल जाती है। मृदा अणुजैविज्ञों ने अपने शोध से प्राप्त प्रतिकिलो के आधार पर यह निश्चित किया कि सामान्य रूप से दलहनी फसलों के बीजों के साथ एजोटोबैक्टर कल्चर एवं सस्य फसलों के बीजों के साथ एजोटोबैक्टर कल्चर को प्रयोग करने के लिए इन कल्चरों की दूनी मात्रा प्रयोग करनी चाहिए। क्योंकि ये जीवाणु उर्वरक (राइजोबियम कल्चर एवं एजोटोबैक्टर कल्चर) फसलोत्पादन में १५-२० प्रतिशत अधिक उपज प्रदान करने में सहायक सिद्ध हुए हैं।

मृदा अणुजैविज्ञों के लिए यह एक महान एवं गूढ़ समस्या है कि फफूदीनाशक एवं कीटाणुनाशक रसायन स्थानीय अणु जीवों की संख्या को किस हद तक भंग एवं परिवर्तित कर देते हैं जिससे फसल की उपज एवं मृदा के गुणों में काफी असमानता आ जाती है। कृषि रसायनों से उपचारित मृदाओं में स्थानीय मृदा अणु जीवों से कितना विघटित एवं विस्थापित होता है। इसलिए जहाँ पर ये कृषि रसायन प्रयोग करने की आवश्यकता समझी जाये वहाँ पर यह सतर्कता भी वर्तनी पड़ेगी कि मृदा की उत्पादकता को बढ़ाने वाले अणु जीवाणुओं पर कम से कम असर पड़े। क्योंकि अणु जैविकी अध्ययनों से यह पता चला है कि नियंत्रित खेत की तुलना में जीवाणु उर्वरकों से उपचारित खेतों में मृदा अणुजीवाणुओं की गड़ना सस्यों में पूर्ण शाखान्वित होने के समय तक एवं दलहनों में फूल आने की अवधि तक बुवाई के पूवं मिट्टी में अणुजीवाणुओं की संख्या की तुलना में क्रमशः ५-१५ प्रतिशत तक बढ़ोत्तरी पायी गयी। ततपश्चात अणुजीवों की क्रियाशीलता बढ़ जाती है। ऐसा कुछ मृदा अणुजैविज्ञों के शोध

कार्यों से प्रमाणित होता है।

कहीं-कहीं इन कृषि रसायनों का प्रयोग पर्णिम छिड़काव के माध्यम से किया जाता है। जिससे फसल की सुरक्षा कीड़ों-मकोड़ों बीमारियों एवं खरपतबार से आसानी से की जा सकती है। प्रधानतया जो कृषि रसायन पर्णिम छिड़काव के लिए प्रयोग किए जाते हैं वे निम्नलिखित हैं :—

लोनोकाल, एम्बिथियान, लेवेसाइड, फोलीथियान, मेटासाइड कांब, मोरेस्टान, रोगार, एवाटाक्स, मेटासाइड ३०, हेलीपोटाक्स, हिनेसान फोलीडाल, लिन्टाफ, डाइथेन जेड ७८, मेटासिस्टाक, एल्ड्रिन, थायोडान २-४ डी.बी. एच डैप्लान आदि। दलहन की फसल जैसे उर्द, मूँग, चना, मटर में जब डाइथेन जेड ७८, मेटा-सिस्टाक २५%, एल्ड्रिन ३०%, रोगार ३०%, थायोडान ३२%, २-४ डी. बी. एवं डैपलान आदि का प्रयोग कर देखा गया तो उपज काफी अच्छी प्राप्त हुई। और शुरू में जड़ ग्रन्थियों की गड़ना में भी एल्ड्रिन एवं रोगार के प्रयोग से क्रमशः २५ से ७५% तक अधिक जड़ग्रंथियाँ अंकित की गई। प्रयोगों से यह भी सिद्ध हो चुका है कि २-४ डी. बी. एवं डैपलान को एक साथ प्रयोग करने से जड़ग्रंथियों की सँख्या में नियत्रित खेत की अपेक्षा काफी कमी पायी गयी लेकिन फसल को देखने से यह भी परिणाम हासिल हुआ कि उपज काफी हद तक अच्छी मिल जाती है। पत्तियों पर उत्पन्न रोगों की रक्षा हेतु जो रसायन प्रयोग किये जाते है उसमें से कुछ सिस्टेमिक फॅजीसाईड एवं इन्सेक्टी-साइड होते हैं जो पत्तियों द्वारा पौधों मे प्रवेश कर जड़ से पसीज कर लाभकारी स्थानीय जीवाणुओं को प्रभावित करते हैं। जिससे उत्पादकता को बढ़ाने वाले जीवाणुओं की संख्या भी ३-५ % तक कुप्रभावित होती है।

अतएव फसल सुरक्षा हेतु चुने गये कृषि रसायनों के विषय में हर कृषक को पूरी-पूरी जानकारी अवश्य रखनी चाहिए। क्योंकि जो भी कृषि रसायन जीवाणु उर्वरक के साथ या अकेले ही प्रयोग किये जाते हैं उनकी सांध्रता का सम्बन्ध सीधे उन जीवाणुओं से हो जाने पर विशेष कुप्रभावी होता है। प्रधानतया दो रसायन मरकरी या सिंदूर युक्त होते हैं। कुछ रसायन ऐसे भी होते हैं जिनमें सिंदूर नहीं होता है उनके प्रभाव में शिथिलता पायी जाती है। कुछ वैज्ञानिकों ने तो कुछ रसायनों को एक विशिष्ट सांध्रता पर उत्पादन में सहायक बतलाया है।

वैसे तो जीवाणु उर्वरकों के साथ इन कृषि रसायनों के प्रयोग सम्बन्धी साहित्य इस समय उ० प्र० कृषि विज्ञान संस्थान से उपलब्ध किये जा सकते हैं। लेकिन यहाँ पर भी वह विधि बतलायी जा रही है। भंडारण सुरक्षा हेतु कृषि रसायनों से उपचारित बीजों को स्वच्छ जल से ३-४ बार निथार लेना चाहिए। तपश्चात १० ग्राम खढ़िया या कैल्शियम कार्बोनेट को ५० शीशी या १ छ० पानी में घोलकर १० किलोग्राम बीज पर लेप कर देना चाहिए। उसके बाद कल्चर की दुगुनी मात्रा को लेकर बीच को उपचारित कर छाये में सुखाकर उसीदिन बो देना चाहिए।

वैकल्पिक विधि :—

यदि उपरोक्त कार्य को करने में कोई असुविधा होती हो या फफूँदीनाशक और कीटाणुनाशक रसायनों को अधिक मात्रा में प्रयोग करना है तो कल्चर की दुगुनी मात्रा तो ले ही लें। लेकिन इस कल्चर को उसी खेत की मिट्टी लेकर जिसमें बुवाई करनी है को १:१ के अनुपात में लेकर अच्छी तरह मिला लेना चाहिए। उसके बाद इस कल्चर युक्त मिश्रण को फिर उसी अनुपात में उसी खेत की मिट्टी को लेकर यह मिलाने की क्रिया जारी रखें जब तक कि एक एकड़ के लिए कम से कम ५० किलोग्राम मिश्रण न हो जाये। अब इस मिश्रण को बुवाई के बाद कूड़ों में डालकर तुरंत पी पाटा चला देना चाहिए।

जहाँ पर रोगों के कीड़ों के बचाव हेतु फफूंदी नाशक एवं कीटाणु नाशक रसायनों को बीजों के साथ उपचारित कर बोना है वहाँ पर भंडारण की भांति कैल्शियम कार्बोनेट के घोल की एक पर्त पूरे बोये जाने वाले बीज पर चढ़ा देनी चाहिए। उसके पश्चात कल्चर की दुगुनी मात्रा से बीजोपचारण कर देना चाहिए। इस तरह बीजोपचारित बीज को छाये में सुखाकर १-१½ घंटे के अन्दर ही बुवाई कर देनी चाहिए। क्षारीय मृदा मे कैल्शियम कार्बोनेट के स्थान जिप्सम के घोल को प्रयोग करना चाहिए। इन जीवाणु उर्वरकों एवं मृदा में उपस्थित अणु जीवाणुओं की रक्षा हेतु ये तकनीकी इसलिए अपनायी जाती हैं कि इन जीवाणुओं द्वारा विशेषकर राइजोबियम जीवाणु द्वारा ५०-६० किलो एवं एजोटोबैक्टर एवं नीलहरि आय का द्वारा १०-२० किलो नमजन अनुबधन का कार्य हरवर्ष होता है जो नभजन अनुबंधन का एक बहुत सस्ता साधन है जिसकी पोधों को बहुत जरूरत होती है।

अतः फसल सुरक्षा हेतु विभिन्न रसायनों को हम उपरोक्त विधियों से प्रयोग कर मृदा मे उपस्थित विभिन्न प्रकार के अणु जीवों की भी रक्षा कर सकते है जिसमे हमें अच्छी उपज भी मिल जायेगी साथ ही साथ मृदा की उत्पादकता को कायम रखने वाले जीवाणुओं की क्रियाशीलता भी यथावत बनी रह सकती है। जिससे कृषक भी इन कृषि रसायनों एवं जीवाणु उर्वरकों को अपनाकर लाभान्वित हो सके।

संतों की बानी सुनो, शास्त्र पढ़ो, विद्वान हो लो, लेकिन अगर ईश्वर को हृदय में स्थान नहीं दिया तो कुछ नहीं किया।

—महात्मा गांधी

बहुमुखी फसल ग्वार

रामलाल परिहार
कृषि महाविद्यालय जोबनेर

ग्वार को भारत में गुनार, थूपी, उराही, छुइन, सुस्ती, गोरोचीकुहु, गोवार, कोथावरनके, कोथावाराज, गोरीकाची, सीनेवराइके आदि कई नामों से पुकारा जाता है। यह फसल भारत में प्रायः सभी भागों मे उगायी जाती है लेकिन उत्तर-भारत में विशेषकर हल्की भूमि में कम वर्षा वाले क्षेत्रों में मुख्यतः राजस्थान, पंजाब, हरियाणा, मध्यप्रदेश, पश्चिमी उत्तरप्रदेश की यह एक महत्वपूर्ण फसल है। ग्वार के बहुमुखी उपयोग के कारण ग्वार की फसल के उत्पादन पर आजकल अधिक बल दिया जा रहा है जिससे औद्योगिक उन्नति के साथ-साथ किसानों की आर्थिक उन्नति में भी वृद्धि हो। ग्वार की फसल के मुख्य गुण निम्नलिखित है।

शुष्क क्षेत्रों की विशिष्ट फसल

कठोर, लम्बे सूखे को सहन करने वाली, कम उपजाऊ एवं हल्की क्षारिया भूमि तथा कम वर्षा की स्थिति में भी सफलता-पूर्ण पैदा होने के कारण यह शुष्क एव अर्द्धशुष्क क्षेत्रों की एक महत्वपूर्ण फसल है।

भूमि सुधारक फसल

लवणरोधी होने के कारण इस फसल को क्षारिय भूमि में हरीखाद के रूप में पुष्पण की अवस्था में उपयुक्त नमी के समय मिला देने से भूमि की क्षारीयता कम हो जाती है। साथ ही भूमि की भौतिक दशा तथा उर्वरता में भी सुधार होता है। ग्वार की जड़ों की गाठों में राइजोबियम जीवाणु होते हैं जो वायुमंडल से ५०-१५० किलो नत्रजन प्रति हैक्टर भूमि में संस्थापित कर भूमि की उर्वराशक्ति बढ़ाते हैं।

बीजों से गोंद प्राप्त करना

ग्वार के बीज में "मोनोग्लैक्टन" नामक म्यूसीलेज या गोंद ३१·४६ से ४३·१६ प्रतिशत पाया जाता है जिसका उपयोग ग्वार गोंद, वस्त्र सज्जीकरण (textile sizing), भोज्यपदार्थों में स्थिरक (Stabilizer), तरल पदार्थों के वर्गीकरण श्वेतसार रंग बनाने में, कारोब गोंद के स्थान पर कागज बनाने में किया जाता है। विभिन्न उद्योगों में उपयोगिता के कारण ग्वार के उत्पादन बढ़ाने पर अधिक बल दिया जा रहा है।

उत्तम दाना

ग्वार का बीज पौष्टिक होने के कारण पशुओं के लिए एक महत्वपूर्ण दाना है। इसके दाने को खिलाने से जानवर जल्दी मोटे होते हैं तथा दूध में वृद्धि होती है। ग्वार के बीज में ३६·३ प्रतिशत अशोधित प्रोटीन, ४·७ प्रतिशत अशोधित वसा, ४६·३ प्रतिशत कुल कार्बोहाइड्रेड तथा ७८·८ प्रतिशत कुल पाचक तत्व होते हैं। ग्वार का दाना अधिक मात्रा में खिलाने से पशुओं को आफरा हो जाता है।

उत्तम चारा

ग्वार के चारे में बरसीम, रिजका जैसी अन्य दलहनी चारे की तुलना में पोषक तत्व अधिक होते हैं। इसके हरे चारे को ज्वार या बाजरा के साथ मिलाकर खिलाने से पशुओं को संतुलित आहार प्राप्त होता है तथा दुधारु पशुओं के दुध में काफी वृद्धि होती है। इसका चारा शीघ्र पाचक तथा पौष्टिक होता है। इसका "हे" भी तैयार कर सकते हैं। ग्वार के हरे चारे के शुष्कभार में १६·० प्रतिशत अशोधित प्रोटीन, १·६० प्रतिशत अशोधित वसा तथा ६५·१ प्रतिशत कुल कार्बोहाइड्रेड होता है तथा ग्वार "हे" में १५·३ प्रतिशत अशोधित प्रोटीन, १·७० प्रतिशत अशोधित वसा तथा ६४·० प्रतिशत कुल कार्बोहाइड्रेड होता है।

भू-संरक्षण में महत्व

ग्वार का पौधा अपनी पत्तियों की सघनता के कारण वर्षा की बून्दों के आघात से भूमि की ऊपरी सतह की रक्षा करता है साथ ही खेत में बहते हुए पानी के वेग को कम करके भूसंरक्षण को रोकता है। गहरी जड़ों वाली फसल होने के कारण भूमि की अन्तस्सरण दर को बढ़ाता है जिससे भूमि की पानी सोखने की क्षमता बढ़ती है।

हरी फली का उपयोग

इसकी हरीफली पौष्टिक एवं स्वादिष्ट होने के कारण सब्जी के काम में लाई जाती है। यह विटामीन ए, विटामीन सी एवं लोह में धनी होती है। शुष्क क्षेत्रों में ग्वार की हरी फली को छाया में सुखाकर सब्जी के लिये एकत्र किया जाता है।

ग्वार के चारे एवं दाने की कम उपज के कारण इसे किसान कम उगाते हैं लेकिन इसकी उन्नत किस्में उगाकर एवं खेती की उन्नत विधियां अपनाकर किसान इसकी उपज काफी बढा सकते हैं।

भूमि एवं जलवायु

अच्छे जल निकास वाली बलुई दोमट, हल्की बलुई भूमि इसके लिए विशेष उपयुक्त है। यह फसल अधिक नमी एवं पानी के भराव को सहन नहीं कर सकती। भारी भूमि में जड़ों की अच्छी वृद्धि नहीं होने के कारण ग्वार की फसल अच्छी नहीं होती है। यह गर्म जलवायु की फसल है तथा अधिकतर वर्षा में पैदा की जाती है। चारे एवं सब्जी के लिए इसे गर्मीयों एवं वर्षा दोनों ऋतुओं में उगाते हैं।

भूमि की तैयारी एवं खाद

दलहनी फसल होने के कारण इसे खुली अच्छी वायुसंचार वाली भूमि की आवश्यकता होती है। चारे की फसल के लिए एक गहरी जुताई मिट्टी पलटने वाले हल से करने के बाद दो जुताईयाँ देशी हाल या हेरो से करनी चाहिए लेकिन फली के लिये भूमि की अच्छी तैयारी आवश्यक होती है। सिंचित अवस्था में २०-३० किलो नाइट्रोजन तथा ४०-५० किलो फास्फोरिक अम्ल प्रति हैक्टैयर की दर से बुआई के पहले भूमि में अर देवें। बारानी दशा में उर्वरकों की मात्रा आधी अर्थात् प्रति हैक्टेयर १० किलो नाइट्रोजन (५० किलो अमोनियम सल्फेट या केल्शियम अमोनियम नाइट्रेट या २२ किलो यूरिया) एवं २० किलो फास्फोरिक अम्ल (१२५ किलो सुपरफास्फेट) प्रयोग करें।

बुआई का समय

चारे की अगेति फसल एवं फली के लिए सिंचित अवस्था में बुआई मार्च में की जाती है। मुख्य फसल मानसून के प्रारम्भ में बोई जाती है जो कि इसकी बुआई का बढ़िया समय है। देर से बुआई करने पर उपज कम मिलती है।

बीजदर एवं बुआई की विधि

बीजदर एवं कतारों की आपस में दूरी भूमि के उपजाऊपन, फसल के उद्देश्य, बुआई के समय एवं सिंचाई की सुविधा आदि पर निर्भर करती है। परीक्षणों के आधार पर छिटकवा विधि की अपेक्षा कतारों में बुआई से अच्छी पैदावार मिलती है। चारे की फसल के लिए ३५-४० किलो दाने की फसल के लिए २५-३० किलो, हरीखाद के लिए ४०-५० किलो तथा फली की फसल के लिए २०-२५ किलो बीज प्रयोग करें। कतारों की आपस में दूरी २५-३० से० मी० रक्खें तथा बुआई ६-८ से०मी० गहरी करें। पशुओं को संतुलित चारा प्रदान करने के लिए इसे ज्वार या बाजरा के साथ मिश्रित फसल के रूप में बोने के लिए बीज की मात्रा आधी प्रयोग करें।

उन्नत किस्में

एक तने वाली किस्में सब्जी के लिए तथा टहनिया वाली किस्में चारे के लिए अच्छी रहती है।

सब्जी के लिए—पूसा सदाबहार, पूसा मौसमी

चारे व दाने के लिए—पूसा नवबहार, नं० २, दुर्गापुरा सलेक्सन, एफ. एस. २ एफ-एस-२२७

सिंचाई

अगेति फसल के लिए गर्मियों में आवश्यकतानुसार ८-१२ दिन के अन्तर से सिंचाई करें। खरीफ में यह फसल वर्षा पर ही निर्भर करती है। लम्बी सूखे की स्थिति में सिंचाई की सुविधा होने पर एक-दो सिंचाई करने से उपज में काफी वृद्धि की जा सकती है। अधिक वर्षा के समय खेत में पानी के भराव से फसल को हानी पहुँची है अत: जल्दी से जल्दी पानी को खेत से निकाल देना चाहिये।

अन्तकृषि

फसल की अच्छी पैदावार के लिए खेत को खरपतवार रहित रखना चाहिए। खरपतवार भूमि जल, प्रकाश एवं खाद के लिए फसल से प्रतिरोध करते हैं अत: खरपतवार नियंत्रण के लिए दो निराई गुड़ाई आवश्यक होती है।

फसलचक्र

बारानी क्षेत्र—(i) ग्वार—बाजरा (दो वर्ष)
(ii) ग्वार—बाजरा+मोठ (दो वर्ष)
(iii) तिल—बाजरा—ग्वार (तीन वर्ष)
(iv) मूंग—बाजरा—ग्वार (तीन वर्ष)

सिंचाई क्षेत्र—ग्वार (हरीखाद)—गेहूँ—मक्का—आलू (दो वर्ष)
ग्वार—जई—मक्का—बरसीम (दो वर्ष)
ग्वार—आलू—मक्का (जायद) एक वर्ष

कटाई

अधिक उपज के साथ-साथ चारा पौष्टिक होना चाहिये। अत: सही अवस्था में ग्वार की कटाई बहुत आवश्यक है। फसल में फूल आना चालू होने से फली बनने के समय अर्थात् बुआई के करीब २-२½ महीने बाद फसल की कटाई करनी चाहिये। इस अवस्था में चारे के शुष्क भार में करीब १८ प्रतिशत अशोधित प्रोटीन होता है जो कि अगले तीस दिन बाद घट कर १२.८ प्रतिशत तक पहुँच जाता है तथा देर से कटाई करने पर डंठल कड़ा होने पर पशु इसे चाव से नहीं खाते हैं। दाने की फसल अक्टूबर-नवम्बर में तैयार होती है। फलिया नीचे से लगना

(शेष ३४ पृष्ठ पर)

मिट्टी का सही नमूना लेवे जभी परीक्षन फलीभूत होवे तभी

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केन्द्रीय भूमि व जल संरक्षण अनुसंधान एवं प्रशिक्षण
संस्थान, देहरादून (यू. पी.)

मृदा परीक्षण क्यों?

उर्वरकों के बाजार भाव तथा किसानों द्वारा उनकी मांग निरंतर बढ़ती देखी जा रही है। हमारे साधारण कृषकों को वांछित उचित उर्वरक व उसकी सही मात्रा का ज्ञान न होते हुये भी उनका प्रयोग कर रहा है। जिससे कभी-कभी उर्वरक का फसल को पूर्ण लाभ नहीं मिलता और फसल पर बुरा असर पड़ जाने का भी अंदेशा रहता है। हालत वैसी ही है जैसे कि अनभिज्ञ डाक्टर निमोनिया के मरीज को हैजे की दवा दें और माँ कब्ज से व्यथित रोते हुए बच्चे को भूखा समझकर जबरन दूध पिलावें। किसी भी फसल की अच्छी उपज लेने के लिये उसके लिये उचित उर्वरक व उसकी सही मात्रा का ज्ञान होना आवश्यक है। यह तभी सँभव है जबकि मृदा का परीक्षण भली भाँति किया जावे।

मिट्टी का नमूना कैसे लें

मिट्टी का नसूना अधिकतर ग्रामों के अनभिज्ञ किसान या ग्रामसेवक द्वारा लिया जाता है। गलत लिये गये नमूने के परीणाम भी गलत होते हैं जिनका बुरा असर किसान की फसल व उसकी आर्थिक स्थिति पर पड़ता है। मिट्टी का नमूना संयुक्त (कम्पोजिट) होना चाहिये जो कि क्षेत्र विशेष का सही प्रतिनिधित्व करता हो और उसको मृदा परीक्षण के उद्धेश्य को ध्यान में रखकर लेना चाहिये। मृदा परीक्षण का उद्देश्य—उर्वरक की किस्म तथा उसकी मात्रा का निर्धारण, क्षारीय व अम्लीय भूमि का सुधार, फलों के बाग लगाने आदि के समय किया जाता है। यहां उर्वरक निर्धारण को ध्यान में रखते हुए मिट्टी का नमूना लेने की विधि निम्न प्रकार दी गई है।

१. क्षेत्र का उर्वरता के आधार पर बंटवारा :—मिट्टी की किस्म ढाल, विभिन्न प्रकार की फसलों के लिये उपयोगिता व उपजाउपन को ध्यान में रखकर पूरे क्षेत्र को १/२-४ हैक्टेयर के छोटे भागों में बांट देना चाहिए।

२. मिट्टी का नमूना लेने के औजार :—

क- १५ से. मी. ऊंचा चौकोर या गोल लोहे का बक्सा (कोर)

ख. फावड़ा, खुरपी, कुदाली

ग. वर्मा (ओगर)—जो कि बेलनाकार, पेचदार (स्क्रू) पोस्टहोल या अन्य प्रकार का हो सकता है।

३. नमूना लेने की विधि :—नमूना लेने से पूर्व ऊपरी सतह का कूडा करकट वनास्पति एवम् बिछावन आदि को खुरच कर अलग कर देना चाहिए। वेलन को हथौड़े की मदद से या वर्मा को हत्थे की मदद से जमीन के अन्दर सीधा १५ से. मी. गहरा पहुंचा देना चाहिए फिर पूरा नमूना निकाल कर प्लास्टिक की बाल्टी या अन्य पात्र में डालते रहते हैं। वर्मा या बक्सा नउ रहने पर खुरपी या फावड़े की सहायता से मिट्टी को १५ से. मी. गहराई तक तिरछा काट लेते हैं फिर इसी सतह से बराबर मोटाई वाला (२ से. मी.) हिस्सा (स्लिट) पूरी गहराई से अलग कर लेते हैं। हरएक क्षेत्र से १०-१५ नमूने लेते हैं ताकि वे पूर्ण रूप से उस क्षेत्र का प्रतिनिधित्व करे। ध्यान रहे कि नमूना हाल ही में डाले गये उर्वरक की जगह, कम्पोस्ट का गड्ढा, दलदली भूमि, मेंड या पेड़ के पास से से न लें। कतारों में बोई गई फसलों में कतारों के बीच से नमूना लेना चाहिये।

४. मिट्टी का संयुक्त (कम्पोजिट) नमूना तैयार करना : लिये गए नमूने से पत्थर के टुकड़े, जड़ें आदि निकाल कर हाथ से या खुरपी से अच्छी तरह मिला कर गोल ढेर बनाना चाहिए। इस ढेर को चार भागों में बांटते हैं। आमने सामने के दो भाग फैंक कर बचे हुए दो भागों को फिर अच्छी तरह मिलाते हैं और फिर चार भागों में बांटते हैं। यह क्रिया तब तक करते हैं जब तक कि ५०० ग्राम के करीब मिट्टी रह जाय। उसके बाद नमूने को धूप में सुखाना चाहिए।

५. नाम पत्र (लेबेल) नमूना के साथ रखने के लिये पेंसिल से दो लेबेल लिखते हैं। एक को थैली/डिब्बा के अन्दर और दूसरे को बाहर लगा देते हैं। लेबेल पर नाम, पता व खेत का नम्बर होना चाहिए।

६. सूचना पत्र : इस पत्र में नमूने का पूर्ण विवरण होता है। यह छपा हुआ पत्र ग्राम सेवक, विकास खण्ड या परीक्षण प्रयोगशाला से प्राप्त किया जा सकता है। कभी-कभी नमूने

रखने के लिए दफ्ती के विशेष डिब्बे भी परीक्षण प्रयोगशाला द्वारा बांटे जाते हैं। जिनमें सूचना पत्र छपा रहता है । सूचना पत्र का कुछ विशेष एवं महत्व पूर्ण विवरण नीचे दिया जाता है।

(१ किसान का नाम व पता (२) खेत संख्या (३) नमूने की संख्या व इसका अभिप्राय (४) सिंचित या असिंचित भूमि (५) जल निकास एवं जमीन में पानी का स्तर (६) जमीन का ढाल (७) फसल-चक्र-तीन (विगत) वर्षा का व पांच आगामी वर्षा का (८) खेत में प्रयोग किये गये खाद व अन्य पदार्थों का विवरण (९) कोई विशेष समस्या एवं वांछित जानकारी (१०) लेवल संख्या (११) नमूने लेने वाले का नाम व तिथि (१२) अन्य सूचनायें।

७. **परीक्षण प्रयोगशालायें :** नमूने को कपड़े की थैली या नमूने भेजने के लिये विशेष प्रकार के बनाये गये दफ्ती के डिब्बों में भरकर तथा नाम पत्र रख कर प्रयोगशाला को सीधे या ग्राम सेवक व विकास खण्ड के माध्यम से भेजना चाहिये। भारत सरकार, प्रदेशीय सरकार व कृषि विश्वविद्यालयों की चल व अचल प्रयोगशालायें काफी संख्या-में अपने देश में कार्य कर रही हैं। आपके क्षेत्र की निर्धारित प्रयोगशाला की जानकारी ग्राम सेवक या विकास खण्ड अधिकारी से मिलेगी।

मृदा परीक्षण कब करायें ?

परीक्षण ३-५ साल की अवधि के अन्तर से अवश्य कराना चाहिये ताकि मिट्टी की वर्तमान स्थिति व उर्वरक की किस्म व मात्रा सही मालूम की जा सके।

मृदा परीक्षण क्या जानकारी देता है?

परीक्षण से हमें मिट्टी की अम्लीयता सारीयता लवणीयता, कार्बनिक पदार्थ एवम् नत्रजन, फासफोरस व पोटास की उपलब्ध मात्रा का ज्ञान होता है। जिसके आधार पर प्रयोगशाला खाद व उर्वरक की किस्म, मात्रा व प्रयोग करने की विधि उगाई जाने वाली फसलों को ध्यान में रख कर निर्धारित करती है। अम्लीयता या क्षारीयता के सुधार के लिये रासायनिक पदार्थ का नाम, मात्रा व भूमि सुधार की विधि बताई जाती है। इसके साथ सूचना पत्र में पूछी गई अन्य समस्यायें जैसे जल निकास, भूमि संरक्षण, बीज की किस्म व उसकी मात्रा का भी समाधान मिलता है।

मृदा परीक्षण की सफलता के कुछ सुझाव :

मृदा परींक्षण का उपयोग केवल कुछ ही किसानों तक सीमित है। अधिकतर किसान इससे वंचित हैं क्योंकि इसके परिणामों में अनभिज्ञ हैं और उचित सुविधाओं की भी कमी है। भारत में केन्द्रीय सरकार, प्रदेशीय सरकार, कृषि विश्वविद्यालय व महा विद्यालयों की ओर अचल प्रयोगशालायें मुफ्त प्रदान कर रही हैं, परन्तु उनकी गति क्षमता से नीचे हैं और जो परीक्षण हो रहे हैं उनका उपयोग कम ही देखने में आता है। जिसके लिए परीक्षण प्रयोगशालायें, विकास विभाग व किसान तीनों ही उत्तरदायी हैं।

प्रयोगशालाओं की जांच व उन्नति के लिये राज्य स्तर पर प्रयोगशाला होनी चाहिये जो एक प्रतिशत नमूनों को प्रयोगशालाओं से चुनकर जांच करें कि परीक्षण यही है या नहीं। यदि नहीं तो कहां कमी है और उसके निवारण का उपाय करे। अभी हाल में ही भारत सरकार का ध्यान मृदा परीक्षण के साधनों को बचाने की ओर गया है और विस्तृत योजना विचाराधीन है। जो कि एक अच्छा कदम है। साथ ही किसानों को अच्छी, सस्ती शीघ्र सुविधा देने के लिये मृदा परीक्षण किट ग्राम पंचायत की ओर से हर गांव में होना चाहिये। ग्राम सेवक या बेरोजगार स्नातक कुछ पैसे लेकर यह कार्य कर सकता है।

विकास विभाग इस मामले में विशेष उत्तरदायी है क्योंकि यह प्रयोगशाला किसान व उसकी फसल के बीज एक महत्वपूर्ण कही है। विदेशों में किसान परीक्षण के लिये काफी पैसा खर्च करता है और फार्म पर भी मृदा परीक्षण किट रखता है परन्तु भारत में यह सेवा निशुल्क उपलब्ध है फिर भी किसान उसके प्रति जागरूक नहीं हैं। अतः किसानों को परीक्षण के फायदों से परिचित कराना, उर्वरक की उचित किस्म व मात्रा प्रयोग करा-के अधिक फसल लेकर मृदा परीक्षण को सफल बनाने का कर्तव्य विकास का ही रह जाता है।

(पृष्ठ ३२ का शेष)

चालू होती है जो पौधे की वृद्धि के साथ-साथ आती रहती है अतः तुड़ाई लम्बे समय तक होती रहती है अतः फलिया सावधानी से तोड़ी जानी चाहिये ताकि पौधों को नुकसान न हो।

उपज

ग्वार की फसल से औसतन हरा चारा सिंचित अवस्था में १६०-२०० कुन्टल तथा बारानी अवस्था में ८०-१२० कुन्टल प्राप्त होता है। दाने की फसल से प्रति हैक्टर १०-१५ कुन्टल दाने की उपज तथा सूखाचारा १५-१८ कुन्टव प्राप्त होता है। सब्जी की फसल से हरी ६०-७० कुन्टल प्रति हैक्टर प्राप्त होती है।

अंधा वह नहीं जिस की आंख
फट गई हो। अंधा वह है
जो अपने दोष ढांकता है।
—महात्मा गांधी

आ प भी सी खें

चौधरी जोधराम की खेती से

मूलचन्द मूदड़ा, जिला विस्तार विशेषज्ञ (मृदा विज्ञान) कृषि ज्ञान केन्द्र हिसार
सूरज प्रकाश सिंह कड़वासरा, विस्तार विशेषज्ञ (मृदाविज्ञान) हरियाणा कृषि विश्वविद्यालय हिसार

भारतीय कृषि अनुसंधान परिषद नई दिल्ली द्वारा हरियाणा कृषि विश्वविद्यालय हिसार को सन् १९७३-७४ के वर्ष में हरियाणा प्रांत में राष्ट्रीय प्रत्यक्षण प्लांट योजना के अन्तर्गत गुड़गाँव, रोहतक, हिसार और अम्बाला जिले में १०२ प्रत्यक्षण प्लांट लगाने का कार्य भार सौपा गया जिसका उद्देश्य है कृषि अनुसंधान कर्ताओं को यह अवसर प्रदान करना कि वे किसानों एवं प्रसार कर्ताओं के सम्मुख यह प्रदर्शित कर सकें कि खेतों से अधिकतम उपज प्रतिक्षेत्र प्रति वर्ष लगातार लेना सम्भव है इस योजना मताहत कृषि विशेषज्ञ किसानों को खेती के सुधरे तरीके अपनाने के लिए प्रेरित करते हुए यह सिखाते हैं कि वर्ष भर में किसी जमीन से अधिक से अधिक शुद्ध लाभ कैसे लिया जा सकता है।

हिसार जिले में एक-एक एकड़ के ऐसे कुल २७ प्रत्यक्षण प्लाट लगाये गये जिनमें वर्ष भर में दो और तीन फसलें लेने का कार्य-क्रम बनाया गया। ये फसल चक्र थे बाजरा गेहूँ, कपास-गेहूँ, धान-गेहूँ, बाजरा-गेहूँ-चरी, धान-गेहूँ मूँग, कपास-गेहूँ-चरी आदि। किन्तु भारतीय कृषि अनुसंधान परिषद के आदेशानुसार हिसार जिले में दो फसली प्रत्यक्षण ही किये गये। तथापि किसान के आग्रह पर प्रत्यक्षण में तीन फसलें बाजरा-गेहूँ-चरी ली गई। यह प्लाट नारनौंद ब्लाक में बुडाणा गाँव के चौ० जोधाराम के खेत पर आयोजित किया गया। क्योंकि ये एक छोटे किसान हैं जिनके पास खेती के लिए केवल २.२५ हैक्टर रकबा है और कृषि की बदली हुई तकनीक अपनाने में काफी दिलचस्पी रखते हैं / काफी मेहनत के बावजूद भी इनके खेतों मे बाजरा और गेहूँ की औसत पैदावार क्रमशः १५-२० क्विन्टल और ३०.५५ क्विन्टल प्रति हैक्टर तक ही रहती थी। इसी उपज को बढ़ाने के तरीके बताने के लिए सन् १९७३-७४ में कृषिज्ञान केन्द्र हिसार के विशेषज्ञों की देख-रेख में इनके खेत पर प्रत्यक्षण प्लॉट रखा गया। जिसने भी खेत की फसल देखी अत्यन्त प्रभावित हुआ। बाजरे की फसल में तो एक विशाल खेत दिवस का आयोजन भी किया गया जिसमें जिले के उपायुक्त महोदय, एस० डी० ओ०, कृषि विभाग के अधिकारी, कृषि विश्वविद्यालय के विस्तार निदेशक और अन्य विशेषज्ञों ने भी खेत में शानदार फसल देखकर मुक्त कंठ से प्रशंसा की।

इस लेख में हम उन्हीं कृषि क्रियाओं का वर्णन कर रहे हैं जो कि किसान ने अपने खेत पर अपनाई।

बाजरा शंकर-३ की काश्त

मिट्टी और पानी परीक्षण :—

भूमि की उपजाऊ शक्ति के अनुसार खाद की मात्रा ज्ञात करने और सिंचाई के पानी की उपयुक्तता जानने के लिए मार्च १९७३ में खेत की मिट्टी और नलकूप के पानी का परीक्षण करवाया गया जिससे यह पता चला कि मिट्टी दुमट, पी० एच० ९१ नमक की मात्रा ०.३० मिलम्होज/सैं० टी० थे। जीवन कार्बन ०.१८ प्रतिशत, प्राप्य फासफोरस तथा पोटास की मात्रा क्रमशः ३४ किलोग्राम और १११६ किलोग्राम प्रति हैक्टर थी। नलकूप के पानी की विद्युत चालकता और सोडियम अवशोषण क्रमशः १७४० माइक्रोम्होज/सैन्टीमीटर और २.८४ थे।

पोषक तत्वों की मात्रा और खादों का प्रयोग :

मिट्टी जाँच के अनुसार क्रमशः १५०,४८ और ३० किलोग्राम प्रति हैक्टर की दर से नाइट्रोजन, फासफोरस और पोटाश की सिफारिश की गई। नाइट्रोजन की आधी मात्रा (७५ कि. ग्रा०) की पूर्ति करने के लिए १६५ किलोग्राम यूरिया का बीजाई के पूर्व छींटा लगाकर जुताई कर, सुहागा लगा दिया। तत्पश्चात् १०० किलो ग्राम ट्रिपल सुपरफासफैट और ५० किलो ग्राम म्यूरिएट ऑफ पोटाश को मिला कर पोर कर दिया। इसके अलावा जस्ते का फायदा देखने के लिए २५ कि० ग्रा० जिंक सल्फेट प्रति हैक्टर आधे खेत में डाला गया। डालने के पूर्व इसे अच्छी तरह पीस लिया गया। और फिर २० से २५ किलो सूखी मिट्टी में मिला कर जब यूरिया डाला गया इसका भी छींटा लगा दिया। नाइट्रोजन की एक-चौथाई मात्रा (३७.५ कि० ग्राम) फसल के फुटाव होने की अवस्था में और बाकी की बची हुई एक चौथाई मात्रा सिट्टे आने के नमय डाली गई। प्रत्येक बार में १५० किलो ग्राम किसान खाद डाला गया।

खेती की तैयारी और बिजाई :

अप्रैल और मई में देशी हल से चार जुताइयाँ की गई और हर जुताई के बाद सुहागा लगाया। बीजाई से एक दिनजुताई देशी हल से और करके सुहागा लगा दिया। सुपरफासफेट पूर्व एक पोटाश को ७.८ से० मी० गहरा पोर कर उसी खूड़ में बाजरे

को भी पोरा विधि से बीजा गया। खूड़ से खूड़ का फासला ४५ से० मी० रखा गया और ३.७५ किलोग्राम बीज प्रति हैक्टर की दर से प्रयोग किया गया। खाद की लगभग ७-८ से० मी० गहरा पोरते गये और उसी खूड़ में बीज को ३-४ से० मी० गहराई पर पोरा गया। बीजाई के लगभग १५ दिन बाद खेत में घने पौधों को उखाड़ कर अन्यत्र जहाँ पर बाजरा कुछ छीदा रह गया, लगा दिये।

निराई-गुड़ाई

बीजाई के १५ दिन बाद जब पौधे छोटे थे तभी कसौलों से एक निराई-गुड़ाई की गई और उसके एक सप्ताह बाद ही दुबारा और निराई-गुड़ाई कर दी गई।

सिंचाई

एक सिंचाई बीजाई के पूर्व पलेवा के लिए दी गई और बाद में दो सिंचाईयाँ खड़ी फसल में की गईं जिसमें पहिली फुटाव के समय और दूसरी दानों में दूध गाढ़ा बनने की अवस्था में की गई। इस प्रकार कुल तीन सिंचाइयों की आवश्यकता हुई और सभी नलकूप से दी गईं।

पौध-संरक्षण

समय पर बीजाई और पर्याप्त मात्रा में खाद पानी देने से फसल की बढ़वार प्रारम्भ से ही अच्छी रही जिसके फलस्वरूप डाउनी मिलडयू (हरे बालों का रोग) का आक्रमण बहुत ही कम रहा। ऐसे पौधें खेत से उखाड़कर जला दिये और बाकी के स्वस्थ पौधों पर १.२५ किलोग्राम ब्लाइटेन को ५००लिटर पानी प्रति हैक्टर, में घोल कर २२ दिन की फसल पर छिड़काव कर दिया। इसी वर्ष खरीफ में सभी फसलों पर पाइरिल्ला का भारी प्रकोप रहा अतः इसके बचाव के लिए फसल पकने के समय १.२५ किलोग्राम बी० एच० सी० प्रतिशत का धूड़ा किया गया।

कटाई और उपज

पाइरिल्ला के भारी आक्रमण से विवश होकर फसल की बिजाई ७५ दिन बाद ही काटना पड़ा और १५ दिन सुखाने के बाद मशीन द्वारा गहाई की गई और उसके अगले दिन ओसाई। इस प्रकार इस फसल से ३५५८ क्विन्टल हैक्टर बाजरा और ८० क्विन्टल हैक्टर सूखी कड़वी मिली। यह भी पता चला कि जिस आधे खेत में जस्ता पड़ा उसमें अन्य भाग की अपेक्षा दाने मोटे बने और उपज भी लगभग ३ क्विन्टल प्रति हैक्टर से अधिक प्राप्त हुई।

गेहूं कल्याण सोना की काश्त :

मिट्टी की जांच और खाद देना

बाजरे की फसल काटने के बाद मिट्टी की उर्वरा शक्ति जानने के लिए पुनः नमूने ले कर जाँच करवाई गई जिसके अनुसार १५६.२५ कि. ग्रा. नाइट्रोजन. ६२.५ किलो ग्राम फासफोरस २२.५ कि. ग्रा. पोटाश और २० किलोग्राम जिंक डालने की सिफारिश की गई। अक्टूबर के प्रथम सप्ताह में लगभग १५ टन गोबर का खाद डालकर जुताइयां कर मिट्टी में भलीभांति मिला दिया। नाइट्रोजन की लगभग आधी मात्रा, फासफोरस पोटाश और जिंक की सम्पूर्ण मात्रा की पूर्ति हेतु ६२,५ किलो ग्राम यूरिया, १२५ किलो ग्राम डी. ए. पी. ५०, किलोग्राम म्युरिएट ऑफ पोटाश और २० किलोग्राम ज़िंक सल्फेट के मिश्रण : का बिजाई के समय पोरा किया। बाकी नाईट्रोजन दो बार करके खड़ी फसल में डाली गई। १२५ किलोग्राम यूरिया पहली सिंचाई के एक सप्ताह बाद वतर आने पर डाला गया और ६२.५ किलोग्राम यूरिया का तीसरी सिंचाई पर फसल में गांठे बनने की आखिरी अवस्था में छींटा लगा दिया गया।

खेत की तैयारी और बिजाई

बाजरा काटने के बाद अक्टूबर में पहली जुताई ट्रेक्टर से और बाद में तीन जुताइयां देशी हल से की गई। इसके बाद बीजाई से एक दिन पूर्व पुनः एक जुताई ट्रेक्टर से करवा कर त्रिफाला चला कर सुहागा लगा दिया गया। खादों को १० से. मी. गहराई पर पोरते गये और पीछे-पीछे उसी खूड़ में गेहूँ का केरा किया गया अथात् हाथ से बीज डालते गये। गेहूँ में तन्दु व ममनी रोग की रोकथाम के लिए बीजाई के पूर्व रात में गेहूँ के बीज को १० प्रतिशत नमक के घोल में डालकर कुछ मिनट से हिलाकर ऊपर तैरने वाले रोगग्रस्त थोथे दानों को निकाल कर जला दिया। बाकी के बचे बीज को तीन-चार बार साफ पानी से धो डाला ताकि उन पर थोड़ा सा भी नमक लगा हुआ न रहे। खूड़ से खूड़ का फासला लगभग २० से. मी. गहुराई पर डाला। इस प्रकार प्रति हेक्टर लगभग १०० किलो ग्राम बीज डाला गया।

निराई-गुड़ाई

सिंचाई और खाद उचित मात्रा में समय-समय पर देने से फसल की इतनी अच्छी बढ़वार हुई कि एक महीने में ही सारा खेत फसल से ढक गया और किसी भी कृषि यंत्र द्वारा घास निकालना संभव नहीं हो सका। अतः १.२५ लीटर २,४-डी का ५०० लीटर पानी प्रति हैक्टर से घोल बनाकर छिड़काव किया गया। और इसी पानी में १२.५ किलोग्राम यूरिया भी मिला दिया। २, ४-डी से खेत में उगने वाले चौड़ी पत्ती वाले घास बथुआ, मेथा, हिरनखुरी आदि जल गये और युरिया से फसल को नाइट्रोजन खुराक मिल गई।

सिंचाई

बिजाई के पूर्व नलकूप के पानी से पलेवा किया गया और

(शेष पृष्ठ ३८ पर)

कटहल खेती

उन्नत तरीका, अधिक लाभ

डा० राजेन्द्र सिंह

भारतीय उद्यान अनुसंधान संस्थान, बंगाल-६

वर्त्तमान पता : भारतीय उद्यान अनुसंधान संस्थान, बंगलोर-६

कटहल का उद्गम स्थान भारतवर्ष में पश्चिमीघाट का भूभाग है, जहाँ से इसका प्रसार अन्य उष्णकटिबंधीय देशों जैसे बर्मा, मलेशिया, ब्राजिल आदि में हुआ है। यद्यपि यह उत्तम प्रकार का फल नहीं माना जाता, फिर भी दक्षिणी भारत में लोग इसे बड़े चाव से खाते हैं और आम तथा केला के बाद इसका अच्छा स्थान है। भारत वर्ष में पश्चिमी तट, कुर्ग, कर्नाटक, राज्य, बिहार तथा उत्तर प्रदेश के कुछ भागों में इसकी खेती की जाती है। बिहार के पत्थरीली भागों जैसे राँची और संथाल परगाना में अधिकतर इसके बाग हैं। फलों में कटहल सबसे अधिक ऊपज देने के लिए प्रसिद्ध है, फिर भी व्यापारिक दृष्टि से यह अधिक लोकप्रिय नहीं है। प्राप्त आंकड़ो के अनुसार उत्तरप्रदेश में ६६० एकड़ तथा बिहार में ९९६० एकड़ में इसके बाग लगे हैं।

जल वायु

कटहल उष्णकटिबंधीय फल है। समुद्र तट से ३५०० फीट की ऊँचाई तक इसके वृक्ष अच्छी तरह फल देते हैं, परन्तु ४००० फीट से अधिक ऊँचाई वाले भागों में फलों का स्वाद अच्छा नहीं होता। अधिक जाड़े या तुषार से वृक्षों को नुक्सान पहुँचता है। सामान्यतः यह गर्मी और ठंडक दोनों सहन करता है। इसके लिए अधिक वर्षा की आवश्यकता है, परन्तु जड़ों में पानी नहीं जमना चाहिए।

मिट्टी

इस फल के लिए दोमट, कंकरीली तथा लाल सभी मिट्टियाँ उपयुक्त हैं। कटहल की जड़ें पानी नहीं सहन कर सकतीं, इसलिए भूमि में जल-निकास की व्यवस्था होना अत्यावश्यक है। यदि जल-निकास का समुचित प्रबन्ध हो तो इसे किसी भी प्रकार की मिट्टी में सफलतापूर्वक उपजाया जा सकता है।

किस्में

कटहल का प्रसार अधिकतर बीज से होता है, इसलिए इसकी निश्चित किस्में ठीक नहीं रह पाती हैं और इनमें अधिक अदल-बदल हुआ करता है। फलों के कड़ापन के आधार पर इनको दो वर्गों में विभाजित किया जा सकता है—कड़े गूदे वाली किस्म और नर्म गूदेवाली किस्म। कोआ के गुणों के आधार पर कटहल की किस्में है—रसदार, खजवा तथा गुलाब की सुगंध-वाला। रसदार—फल बड़े तथा रसदार होते हैं और इन्हें काटकर नहीं खाया जाता। खजवा—कम रस और सन-रहित होता है तथा काटकर खाया जाता है। गुलाबी—इसमें रसदार से कम रस तथा सन होता है, लेकिन खजवा से अधिक। यह खाने में स्वादिष्ट होता है। तरकारी वाली किस्मों में भीतर का गुदा छोटा-छोटा, फल भी आकार में छोटा तथा बीज अधिक होते हैं। सिंगापुरी किस्म श्रीलंका से लायी गई है, जो जल्द फल देने-वाली किस्म है गुणों में फल मध्यम श्रेणी के होते हैं।

प्रसार

कटहल का प्रसार मुख्यतः बीज से होता है। साधारणतः पौधे लगाने के स्थायी स्थान पर ही बीज लगा दिया जाता है। ऐसे बीज नर्सरी में लगाकर पौधों को भी लगाते हैं। ताजा बीज व्यवहार में लाना अच्छा होता है। ५-६ सप्ताह में बीज से पौधे निकलते। साटा बाँधकर तथा अंश से प्रसार में भी सफलता मिली है। साटा जुलाई के माह में बाँधते हैं। इसके लिए पौधों को गमलों या क्यारियों में उगाया जाता है तथा छः महीने से एक साल के बाद इनको कलम लगाने के काम में लाया जाता है। साटा बाँधे हुए पौधों को मातृ वृक्षों से अलग करने के [illegible] महीने बाद स्थायी स्थानों में लगाया जाता है।

पौधों को लगाना

कटहल के वृक्ष बड़े आकार के होते हैं, इसलिए पौधों के बीच की दूरी २५-३० फीट रखते हैं। पौधे लगाने के स्थान पर गर्मी के दिनों में तीन फीट व्यास का गोला गड्ढ़ा तीन फीट गहरा खोदते हैं। कुछ सप्ताहों तक गड्ढ़ों को खोदकर खुला छोड़ देते हैं और जून के प्रथम सप्ताह में उपयुक्त खाद मिट्टी में मिलाकर जमीन की सतह से ५-६ इंच ऊँची भर देते हैं। पौधे अगस्त-सितम्बर में लगाया जाता है।

खाद

कटहल के वृक्ष बड़े-बड़े होते हैं। तथा फल भी बड़े-बड़े लगते हैं। अतः खाद पदार्थ की अधिक जरूर होती है। निम्न खाद-तालिका उपयुक्त समझी जाती है—

खाद देने का समय	खाद का नाम	खाद की मात्रा—प्रौढ़ प्रथम वर्ष-प्रतिवर्ष वृक्षों में बढ़ाने की मात्रा	
अगस्त एवं जनवरी	गोबर की सड़ी खाद	१ मन	१० सेर
	पत्ती की खाद	१० सेर	४ सेर
			$2\frac{1}{4}$ मन
			१ मन

सिंचाई एवं अन्य सावधानी

नवजात पौधों में गर्मी में हर सप्ताह एकबार तथा जाड़े में

प्रति दो सप्ताहों पर पानी पटा सकते हैं। दक्षिणी भारत के मालनद और नीचे पहाडी क्षेत्रों में सिंचाई की विशेष आवश्यकता नहीं पड़ती। जब कटहल के पेड़ फूलने और फलने लगते हैं तब उनके लिए सिंचाई का प्रबन्ध करना जरूरी है।

उत्तरी भारत में कटहल के पौधों के बीच में पपीता, तिपारी तथा मौसम सब्जियाँ एवं दक्षिणी भारत में सुपारी, काफी, इलायची और काली मिर्च ७-८ प्रारम्भिक वर्षों में ली जाती है। इन पौधों के लिए खाद, पानी एवं निराई-गुड़ाई की व्यवस्था करनी पड़ती है, जिनका लाभ कटहल के पौधों को भी पहुँचता है।

फलन

रोपाई के ७-८ साल के बाद कटहल में फल लगते हैं। वृक्ष के तना तथा डालियों पर फल लगते हैं तथा एक स्थान में एक ही फल रहता है। फल बहुत छोटी डंडी के सहारे तना से लगा रहता है। तना का जो भाग जमीन के अन्दर रहता है उसमें भी फल लग जाया करता है और इस प्रकार के फल लगने से जमीन फट जाती है। ऐसा फल काफी स्वादिष्ट होता है। जाड़े के दिनों में इसमें फूल लगते हैं और गर्मी में फल आते हैं। फलों का आकार बड़ा होता है और २५ किलोग्राम तक के फल पाए जाते हैं। साधारणतः तथा एक एकड़ से २००-२५० मन ऊपज मिल जाती है।

उपयोग

(१) कच्चे फल की सब्जी बनती है। (२) इसके बीज से भी सब्जी तथा आय बनाया जाता है। (३) कच्चे फलों का आचार बनाया जाता है। (४) फलों से छोटे-छोटे पापड़ बनाए जाते हैं। (५) पक्का फल खाया जाता है। (६) फलों से शर्बत, मुरब्बा, मीठी चटनी तथा डिब्बे बंदी आदि तैयार होते हैं। (७) वृक्षों की लकड़ी कीमती होती है। (८) पत्तियाँ मवेशियों को खिलायी जाती हैं। (९) फलों में खनिज प्रत्यों के अतिरिक्त विटामीन ए और सी पर्याप्त मात्रा में पाए जाते हैं।

कीड़े तथा बीमारियाँ

कोंपल-छेदक गिड़ारों से अधिक नुक्शान होता है। वे फल के अन्दर घूस जाते हैं और फलों में छेद करके खराब कर देते हैं गैमेक्सीन की बुकनी छीट देने से इन कीड़ों का नाश किया जा सकता है। सफेद गंधी कोपलों और कलियों का रस चूसते हैं तथा शल्क कीट पत्तियों और टहनियों पर पाए जाते हैं और गंधक के घोल छिड़कर या गंधक को भुरककर इन कीड़ों का आक्रमण रोका जा सकता है।

छोटे-छोटे फलों में फफूंदी-जनित सड़न रोग का प्रकोप होता है, जिसके कारण फल सड़कर गिरने लगते हैं। बोर्डो मिक्चर का छिड़काव फूल निकलते ही और उसके बाद ३-४ सप्ताह में एकबार करते रहने से लाभ पहुँचता है। इसके अतिरिक्त गुलाबी रोग, तना गलन आदि प्रमुख रोग हैं। रोग-ग्रस्त भागों को काटकर बोर्डो मिक्चर का छिड़काव करने से सभी रोगों से बचाव किया जा सकता है।

(शेष पृष्ठ ३६ पर)

बाद में खड़ी फसल में कुल ६ सिंचाइयाँ की गई। ये सिंचाईयां समय-समय पर फसल की आवश्यकतानुसार क्रमशः शिखर जड़े निकलने, फुटाव की अन्तिम अवस्था में, गाँठ बनने के समय, गाँठ बनने की अन्तिम अवस्था में, बालियां और दानों में दूध गाढ़ा बनने की अवस्था में दी गई। सभी बार पानी नलकूप से दिया गया।

पौध संरक्षण

दीमक की रोकथाम के लिए २५ किलोग्राम बी. एच. सी. १०% का प्रति हैक्टर से खेत में अन्तिम जुताई के समय तीन-चार बार गुणी मिट्टी में मिश्रित कर छींटा लगाकर जुताई कर मिट्टी में मिला दी गई।

कटाई और उपज

बीजाई के १५५ दिन बाद फसल को दांती से काटी गई और भरौंटे (बण्डल) को एक सप्ताह तक धूप में सुखाकर मशीन (ड्रमी) द्वारा गहाई और औसाई की गई। इस प्रकार ६०.५० क्विंटल दाना और ७१.०० क्विंटल भूसा प्रति हैक्टर प्राप्त हुआ।

चरी के लिए ज्वार की काश्त

गेहूं काटने के लगभग एक सप्ताह बाद खेत का पलेवा कर दिया और बत्तर आनेण्ट पर देशी हल से चार जुताइयां कर दी गई। उसके बाद १५ किलो ग्राम ज्वार जे. एस:२०, ५ किलोग्राम लोबिया नं. १० और लगभग ५०० ग्राम बाजरा के बीज का मिश्रण पोरा विधि से बीजा गया। गेहूं की फसल में खाद की अच्छी मात्रा देने से मुख्यतः गोबर की खाद के प्रयोग से ज्वार में कोई खाद नहीं डाला गया। नलकूप द्वारा समय-समय पर सिंचाई करते रहे। जून के आखिर में फसल की जब ८-९ फुट बढ़वार हो गई तो हरी अवस्था में ही काट ली जिससे लगभग २०० क्विंटल हरा चारा मिला।

उपरोक्त तीन फसलें उगाने पर चौ. जोधाराम को प्रति हैक्टर ८३०५-८४ का शुद्ध लाभ Net Profit हुआ। इन फसलों के उगाने में विभिन्न कृषि क्रियाओं पर किया गया व्यय तालिका नं. १ में दिया गया है। फसलों की उपज और उनसे मिलने वाला समग्र प्रति फल तालिका नं. २ दिखाया गया है। इस फसल-चक्र से मिलने वाला शुद्ध लाभ और बाजरा तथा गेहूं का प्रति क्विंटल दाना पैदा करने की लागत को भी तालिका नं. २ के नीचे दिया गया है।

तालिका नं० १

व्यय का ब्यौरा

क्र० सं०	कृषि क्रियाएं	फसल खर्च प्रति हैक्टर (रुपयों में)		
		बाजरा	गेहूं	हराचारा
१.	खेत की तैयारी	१८७.५०	२५०.००	२००.००
२.	बीज	३३.७५	१४५.००	६९.५०
३.	खाद की कीमत और डालने की मजदूरी	५५२.९०	७६९.८०	—
४.	बीजाई, छिदराना या खाली स्थान में पौद लगाना	१०७.००	१८.७५	६२.५०
५.	सिंचाई और मजदूरी खर्च	७५.००	११८.९०	९०.००
६.	निराई-गोडाई	२००.००	४१.९०	—
७.	कीटनाशक-कवकनाशी दवाइयों का प्रयोग	४०.७५	१६.३०	—
८.	मालगुजारी	१.८८	२०.००	२०.००
९.	खेत की रखवाली	१००.००	—	—
१०.	कटाई-मड़ाई और दोनों की सफाई	३४९.७५		
११.	नकद व्यय पर ब्याज (फसल वृद्धि की आधी अवधि के लिए १०% दर से)	६.८६	२४.१८	३.८४
	कुल व्यय =४२१८.५६ रु.	१६५५.३९	१९२९.८३	

तालिका नं. २

आय का ब्यौरा

क्र. सं.	फसल	वजन (क्विंटल/हैक्टर)	दर (रुपये)	कीमत	दाने और भूसे में समय प्रति फल (रुपयों में)
१.	**बाजरा**				
	दाना	३५.३८	८०.००	२८३०.४०	३२३०.४०
	कड़वी	८०.००	५.००	४००.००	
२.	**गेहूं**				
	दाना	६०.५०	११००.००	६६५५.००	७२९४.००
	भूसा	७१.००	९.००	६३९.००	

३.	हरा चारा				
	ज्वार+लोबिया+				
	बाजरा	२००.००	१०.००	२०००.००	२०००.००

कुल प्रतिफल—१२५२४.४० रु०

बाजरा, गेहूं, ज्वार, चरी से प्राप्त समग्र प्रतिफल —१२५२४.४० रु०

बाजरा-गेहूं, ज्वार चरी से शुद्ध लाभ — ८३०५.८४

इस प्रकार किसान को प्रति एक रुपया खर्च करने पर २.९७ रु. प्रतिफल मिला। किन्तु फी रुपया खर्च करने पर बाजरा, गेहूं, और ज्वार चरी में क्रमशत १.९५ रु., ३.७८ रु. व ३.१६ रु. प्रतिफल मिला।

प्रति क्विंटल बाजरा और गेहूं पैदा करने की लागत क्रमशः ४६.७९ और ३१.९० आई।

नोट : १. उपरोक्त लेख में सभी खर्च प्रति हैक्टर के आधार हर किया गया है। एक हैक्टर—२.५ एकड़

२. बाजरा, गेहूं और चरी की फसल उगाने में खर्च का जो हिसाब लगाया गया है उसमें अचल पूंजी का लगान और अचल पूंजी का ब्याज तथा प्रबंधक की मजदूरी को सम्मिलित नहीं किया है।

चौ. जोधाराम ने वर्ष में तीन फसलें उगाकर अपने क्षेत्र में पैदावार प्रति एकड़ लेने में नया कीर्तिमान स्थापित किया और अपनी औसत पैदावार को दुगुना कर दिया जो कि अन्य कृषकों के लिक अनुकरणीय है। यदि अन्य किसान भी जोधाराम द्वारा अपनाए गये तरीकों को समय पर करें तो निःसंदेह अपनी फसलों के उपज को काफी सीमा तक बढ़ा सकते हैं जिससे आजकल के आर्थिक संकट में स्वयं का तो भला होगा ही साथ में एक बड़ी देश सेवा भी।

जगत द्वन्द से भरपूर है। सुख के पीछे दुःख रहा है, दुःख के पीछे सुख। धूप है तो छाया भी है, प्रकाश है तो अंधेरा भी, जन्म है तो मृत्यु भी। इस द्वन्द से हटना अनासक्ति है। द्वन्द को जीतने का उपाय द्वन्द को मिटाना नहीं है, द्वन्दातीत अनासक्त होना है।

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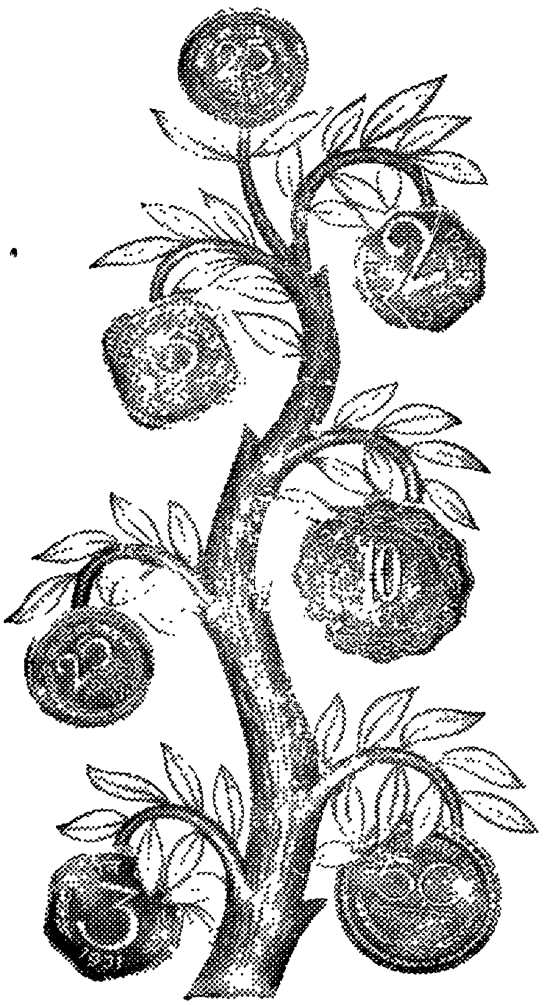

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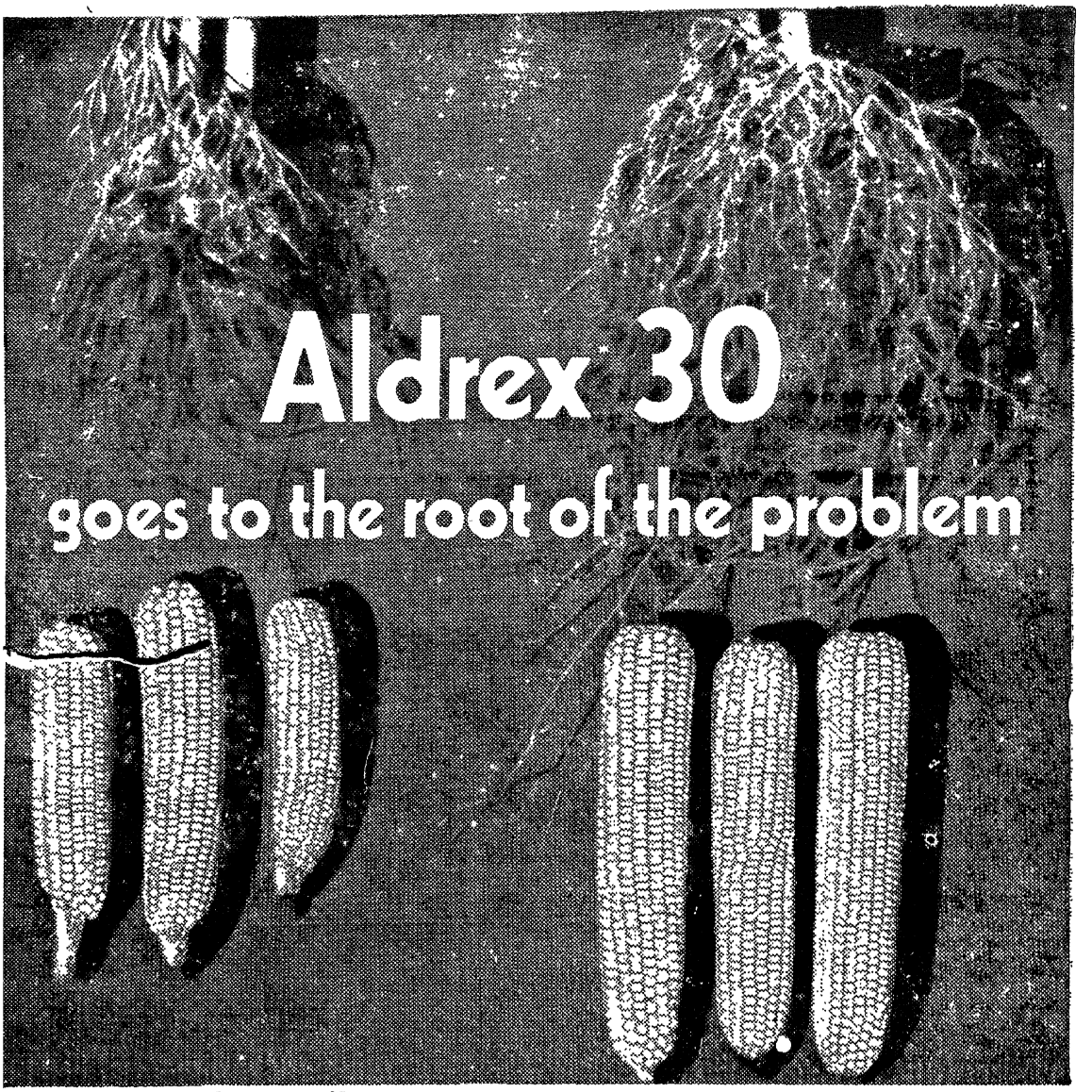

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FARMER AND PARLIAMENT

VOL. XI NO. 2 FEBRUARY 1976

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OUR COVER

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Editor's Page

Nature has been merciful this year. The monsoon has been adequate and timely on the whole. In a vast country of the size of India some small deficiencies in small pockets even during a year of good production are bound to happen. However, the production of agricultural commodities this year is expected to be much above the average, if not a bumper one. The production of cotton has already touched the all time high particularly the production of long staple varieties, The production of Food grains is expected to touch the target of about 114 million tonnes. This, so far as it goes, is highly satisfactory from the national point of view. The point, however, is whether the bumper harvest will benefit the producers also ?

In the case of cotton, the farmers of the cotton growing areas had a bitter experience this year. With the record production of long-staple varieties of cotton, the prices of these varieties declined sharply and a tremendous effort had to be put in to sustain the prices at suitable levels so as to ensure that the farmers did not suffer. The Farmers' Parlimentary Forum had to approach time and again the Governmental authorities to take various measures to give support to the prices. At the suggestion of the Forum, the Government decided to allow limited export of cotton.

The rabi crop is now in sight. In certain areas, the harvesting of wheat has already started. By the middle of April the harvest will be in full swing. The indications are that the crop will be a bumper one. The prices have already started falling. It is true that during the last two years the prices had risen quite high. But the risk now is that they may fall below the economic prices of the farmer and hit him hard. It has to be remembered that the prices of inputs which the cultivators had to use for the production of wheat had risen quite high and the cost of production had, therefore, been much higher. If after the bumper harvest the prices of wheat fall below the economic level it will be very unfortunate as that would cause disstress to the farmers of the wheat growing areas.

The Minister for Agriculture and Irrigation has given a public assurance that the Government would not allow the prices of wheat to fall below Government procurement prices. This is a welcome assurance so far as it goes. The real problem is implementation of the Goverumant policy. Past experience shows that the Government procurement machinery moves too slowly. By the time the purchasing organisation of the Government starts functioning the grain markets, the private traders manage to fleece the poor farmers who bring their produce to the market immediately after the harvest. Numerous instances have come to notice where the farmers had to give up their foodgrains at low prices to the private trade because of the Government machinery not functioning and the farmers in any case had to dispose of the stocks brought to the market. We do hope that this time the Government will take timely action to ensure that the private traders were not able to exploit the poor farmers who bring their foodgrains to the market soon after the harvest. The Government purchase machinery should be spread out properly through out the country and no loophole should be left which could enable the private trade to make hay.

In certain states the responsibility for procurement has been assumed by the State Governments themselves. The procurement machinery in all states is not equally efficient. In those states where the State Government Procurement organisation is not strong enough, the Central Government should not hesitate to suplement the State Government purchasing machinery by making the Food Corporation of India also to enter the market. To maintain the enthusiasm of the farmer to produce more it is very necessary that he should get remunerative prices for his produce.

Bhindi by the Basketful

Many farmers have struck it rich with summer bhindi.

This has been mainly possible because of the coming of a variety like Pusa Sawani that combines high yield with resistance to the deadly disease—yellow mosaic. Many farmers have been making as much as Rs. 5,000, if not more, from an acre of Pusa Sawani crop.

New and Disease-Free Bhindi

Now comes another variety that can defy the disease even better. At the same time, it yields as high as Pusa Sawani. Developed by the Scientists of the Indian Agricultural Research Institute, New Delhi, the new bhindi is named S-1-1.

Seeds of this variety are being made available for sowing this season. But the supply is limited. Naturally, everybody won't be able to try out the new variety. Farmers can, however, build up their profits around the already proven varieties. Whosoever did make most profits out of these varieties, followed a package of soundpractices.

Besides Pusa Sawani, Pusa Makhmali, Perkins Green Long and Darbhanga Long are the other recommended varieties. Pusa Makhmali as the name tells, produces tender pods but gets mosaic virus easily.

No sooner the grip of cold is lifted, it is better to sow the bhindi for raising a summer crop. This will be around the middle of February to the end of March. According to an experiment conducted in Bichpuri, Agra, the summer crop fetches a better profit when sown in February and on ridges, wherever possible, rather than on flat beds or at any other time. You may try it on a small plot to see it for yourself.

Needs Good Feeding

Bhindi crop will give well if fed well. If taken after a heavy feeder like itself, say potato, it is essential to manure and fertilize it in heavy doses. Apply about 20 cartloads of farm-yard manure also. Use 125 kg of CAN or ammonium sulphate, 150 kg of superphosphate and 100 kg of muriate of potash. Fertilizers are better drilled in rows just before sowing.

The field should be freed of all stubbles and made friable. Twenty-two kilos of BHC should be mixed in the soil where termite is a big problem.

Good Seed—A Must

Before sowing, seed should be put in water and all floating seeds discarded. The remaining seed should be allowed to soak for about 24 hours.

Twenty to 25 kg of good seed should be sufficient for a hectare. Put the seeds in furrows, made 45 cm to 60 cm apart. The seeds are spaced at about 15 cm and put not more than 4 cm deep. Moisture at sowing and also at flowering and fruit-setting is most important.

Top—Dressing Counts

Top-dressing done about a month after sowing will provide an abundance of pods. Give 100 kg of ammonium sulphate. Back this up with two sprays of one per cent urea at 10-days intervals.

Dealing with the Enemies

Even though it is claimed that the summer bhindi suffers less from yellow mosaic, it will pay to keep a watch. The veins of the leaves turn yellow in affected plants. Powdery mildew also can greatly harm the crop. Bootches of white powdery coating on the leaves surface warns the presence of the disease. Dust wettable sulphur like Siokol or Solebar.

Tiny Jassids are also a big profit stealer. They remain in the under surface of the leaves and suck the plant sap, causing the leaves to curl. Spraying 10 to 12 c. c. Malathion in 5 litres of water can take care of the pest. The crawling caterpillars, that bore into fruits and shoots, can be checked by spraying Matasystox or Endrin 80 to 100 c. c. mixed in 5 litres of water.

Before applying any pesticide, better pick the fruits that are ready. No fruits should be harvested within three days of spraying.

With summer bhindi, every bit of good care fetches high dividends. (F.I.U.)

Increasing Plant Productivity in the Indian Arid Zone

R. P. Singh & M. V. R. Prasad

Chief Scientist and Plant Breeder, respectively, Dry Farming Research Main Centre, Central Aid Zone Research Institute, Jodhpur (Rajasthan).

Abstract

Despite extreme moisture deficit, it is possible to increase the plant productivity in the arid areas by extending afforestation and rangeland management technology to the arid areas receiving less than 300 mm of rainfall; and a combination of farm forestry, improved pasture management and a suitable dryland crop production technology dovetailed to the variations in agro-meteorological conditions, to the regions receiving 300-400 mm of annual rainfall.

Researches carried out at the Central Arid Zone Research Institute, Jodhpur resulted in the identification of suitable species of trees such as *Eucalyptus melanophila, E. tessellaris, E. coolabah, E. camandulensis, Acacia tortilis, A. victoriae, A. ligulata* and *A, aneura* for afforestation and methods of enhancing survival of planted tree seedlings. Among perennial forage grasses, *Cenchrus ciliaris, C. setigerus* and *Lasiurus sindicus* have been found to be highly suitable for remunerative pasture development. A system of inter-cropping of appropriate varieties of annual grain legumes with forage grasses, would be helpful in maximising the plant productivity in the years of good rainfall and stabilising in the years of drought.

Although the task of evolving a strategy for remunerative crop production is said to be onerous, an appropriate crop planning involving new remunerative crops like sunflower and castor, to diversify crop production, forages, and promising varieties of traditional crops such as NHB3-1 of bajra, S8 and M8 of *moong*, FS68 of cowpeas, T13 of sesamum and FS277 of *guar*, coupled with a flexible technology of moisture conservation, fertiliser use, dovetailed to the variations in rainfall pattern, has been found to put the crop production on these drylands on a sound footing. In addition, cultivation of remunerative crops such as mustard and safflower with low water requirement, in the *rabi* season, was found to be helpful in increasing the crop production per unit of water.

For cold desert conditions in Ladak region, afforestation with tree species such as *Salix* and *Populus*, and cultivation of quick growing and short duration cereals, oilseeds and fodders offer great promise.

It is suggested that the complex problems of increasing plant and animal productivity in these areas can be best handled at the national level based on a national plan for ameleoration of arid conditions.

Arid areas are characterised by extreme moisture deficit leading to a sparse vegetation cover, with a con-comitant erosion of soil and depletion of soil nutrients. The problems imposed by a low annual precipitation are accentuated by its frequent erratic distributions from season to season, a high solar incidence of 450-550 calories per cm^2/day and wind velocity of 10-20 kmph resulting in a high potential evapo-transpiration. The soils being light and sandy in nature with low organic matter content (0.1% to 4.5%) have a very poor moisture holding capacity (25-28%) and a high infiltration rate of 9 cm/hr.

Though the arid zones of India have their origin in the acute shortages of precipitation in relation to water need, an interesting feature, perhaps of immense ecological significance, is that the megathermal sections of the arid zone, especially at low elevations, summer concentrations are meso-thermal in nature, implying restricted development of forest type of vegetation. On the other hand at very high elevations in the meso and micro-thermal regions of the arid zone, summer concentrations of thermal efficiancy are more favourable for vegetation growth, in spite of the overall annual thermal efficiency

being somewhat deficient for forest vegetation development (Kaul 1970). These various features, arising presumably on account of the continentality characteristics of climate (Subrahmanyam 1963), determine not only the seasonal aspects like deciduousness or otherwise of the species but may even have profound influence on the introduction or thrival of exotic types of vegetation in the concerned regions. Another asset of the arid zone is the abundant sunlight which can be capitalised.

Increasing plant productivity in the arid areas, although beset with many problems, can be feasible, provided an appropriate strategy involving adapted species and types of trees and shrubs, forage grasses and field crops is adopted, maintaining a favourable ecological balance. Developing shelter belts of appropriate tree species such as *Eucalyptus* and *Acacia tortilis* and vegetation cover on the soil comprising forage grass species such as *Lasiurus sindicus*, and *Cenchrus species* is of foremost necessity to check excessive wind velocity and soil erosion and thereby create a favourable micro-climate for better and increased plant productivity including crop production.

The hot arid zone comprising 3.2 lakh sq. kms. in Rajasthan, Haryana, Gujarat besides small pockets in Rayalaseema region of Andhra Pradesh and adjoining parts of Mysore can be divided into two groups viz, (1) the regions receiving less than 300 mm of annual rainfall, and (2) those receiving 300-400 mm of annual rainfall. The regions receiving less than 300 mm of annual rainfall are characterised by extreme arid conditions and as such rainfed crop production would be a highly risky proposition in such areas. Occurrence of bare and shifting sand dunes and vast stretches of barren soil is a common feature of these areas.

Here, the continuously eroding soil progressively contributes to the dust content of the atmosphere, leading to a decreased rate of solar radiation admittance and consequently the temperature of the surface soil and vegetation during the day is lowered while the night temperature is increased. This sort of situation interferes with dew formation with the result that much of the atmospheric moisture remain untrapped for growth of plants, as the present dust content over the Rajasthan desert has been estimated as 5,500 tons (Kaul 1970).

The most rational approach to the problem, considering the land capability in the region will be by following an extensive and integrated soil conservation plan which, besides taking into account improved agronomical and range management practices, should include the afforestation of shifting dunes, raising of wind breaks around cultivated fields where irrigated agriculture is practised to protect crops from the desicating winds and thus ensuring efficient utilization of available water, raising of village wood lots on different land types by modifying the physical limitations imposed by environment and planting of fodder tree and shrub species in range lands to provide shade and nutritive top feed to the animals. These shrubs and trees also provide protection and create conditions conducive to the natural regeneration of high yielding and palatable perennial grasses in the range thus improving its carrying capacity (Kaul and Ganguli 1963, Gunguli *et al* 1964).

Seasons characterised by adequate and favourable rainfall distributions should be capitalised for undertaking planting of trees and grasses in these regions.

Afforestation : The local vegetation of the arid zone comprises thorny trees such as *Acacia senegal*, *Salvadora oleoides*, *Prosopis cineraria*, *Acacia leucosephala*, and *A. nilotica*, shrubs such as *Capparis decidua*, *Zizhyphus nummuloria*, *Cassia auriculata*, *Indigofera oblongifols*, *Calotropis procera*, *Leptadenia pyrotechnica* and *Calligonum polygonoides*. Among grasses, the predominant species are *Cenchrus* spp., *Lasiurus sindicus* and *Panicum turgidum*. The tppical community of north west desertic region which is fully infested with high to medium dunes is *Calligonum polpgonoides—Panicum turgidum*. Old and well stabilised dunes are generally occupied by small trees and shrubs of *Prosopis cineraria*, *Salvodora oleoides*, *Capparis decidua*, *Zizyphus numularia* and *Tecomella undulata*. In low lying depressional and saline areas, the open shrub community of halophytic species such as *Haloxylon salicornicum*, *Suaeda fruiticosa*, *Atriplex crassifolia*, *Salsola foetida*, *Zygophyllum simplex*, *Sporoblus marginatus*, *Aeluropus lagopoides* and *Cressa critica* are met with. As the local tree species of the arid areas of the country are extremely slow growing and meagre in number, there is every need to enrich the vegetation by introducing tree species of higher rate of growth and resistance to drought and cold from iso-climatic regions of the world (Kaul 1970)

Investigations carried out at the Central Arid Zone Research Institute, Jodhpur by Kaul and his

(*Contd. on page 21*)

GREAT MEN SPEAK

Just as joy and sorrow are a pair that follow each other in succession, so is the case with all things in life. Consequently, to have real peace of mind, we must rise above such pairs of opposites.

Mahatma Gandhi

He alone lives in whose heart dwells Rama (God) and who is ever aware of such presence.

Mahatma Gandhi

One can never find truth if one is not wide awake every moment of one's life.

Mahatma Gandhi

Fear Vanishes only with the annihilation of the ego.

Mahatma Gandhi

What seems impossible is not always really so.

Mahatma Gandhi

He who remembers God can afford to forget everything else.

Mahatma Gandhi

If there is a soul, then surely the Supreme Soul (God) too, exists.

Mahatma Gandhi

Because we are corporeal, we cannot have a conception of the personality of God.

Mahatma Gandhi

There are two aspects of things, the outward and the inward. It is purely a matter of emphasis with me. The outward has no meaning except in so far as it helps the inward. All true art is thus the expression of the soul. The outward forms have value only in so far as they are the expression of the inner spirit in man. Art of that nature has the greatest possible appeal for me.

Mahatma Gandhi

All true art must help the soul to realise its inner self. In my own case, I find that I can do entirely without external forms in my soul's realisation. My room may have blank walls; and I may even dispense with the roof, so that I may gaze out upon the starry heavens overhead that stretch in an unending expanse of beauty. What conscious art of man can give me the panoramic scenes that open out before me, when I look up to the sky above with all its shining stars? This, however, does not mean that I refuse to accept the value of productions of art, generally accepted as such, but only that I personally feel how inadequate these are compared with the eternal symbols of beauty in Nature. These productions of man's art have their value only so far as they help the soul onward towards self-realisation.

All truths, not merely true ideas, but truthful faces, truthful pictures, or songs, are highly beautiful. People generally fail to see beauty in truth, the ordinary man runs away from it and becomes blind to the beauty in it. Whenever men begin to see beauty in truth, then true art will arise.

Truly beautiful creations come when right perception is at work. If these moments are rare in life they are also rare in art.

Mahatma Gandhi

We have somehow accutomed ourselves to the belief that art is independent of the purity of private life. I can say with all the experience at my command that nothing could be more untrue. As I am nearing the end of my earthly life I can say that purity of life is the highest and truest art. The art of producing good music from a cultivated voice can be achieved by many, but the art of producing that music from the harmony of a pure life is achieved very rarely.

Mahatma Gandhi

A nation is not a juxtaposition of individuals. It is a society based on a communion of minds, a union of hearts. The great everlasting things that matter for nations, especially our own nation, are the peaks of wisdom, love and sacrifice which have come down to us from over forty centuries. As long as we carry in our hearts the image of these great peaks whose foundations are not shaken, though the earth may rock and sway, our future is safe. India for centuries has been a mother to all those who made this country their home and helped them by providing intellectual nutriment and spiri-

tual solace even as a mother lets each one of her children find in her the comfort each individually needs. The children are not alike ; they are different. Only the differents can unite on the basis of the unity of all life, the reality residing in each individual and the joy of fulfilment when truth is attained. We should preserve this great spirit of hospitality to varied beliefs, freedom from the tyranny of dogmas, which has been the secret of our strength.

Dr. Radha Krishnan

Humility must be the paramount characteristic. Chances, circumstances place us all in different positions and by that we should not be misled. There is a famous Sanskrit verse which says, "There are people who have the conceit of learning, others have the conceit of wealth, others have the conceit that they are born in a great family. Learning, wealth and good birth are a source of conceit to the uncultured. To the cultured they are the means for the exercise of self control".

Dr. Radha Krishnan

"*Mada*" must become '*dama*'. Conceit must be transformed into discipline and self control. Each one of us in doing his or her work must look upon it as a sacred task. Other things will be forgotten : the wealth you pile up, the career you make for yourself, all this will, say in fifty years, be forgotten altogether. But if you have the satisfaction that in your day the task assigned to you was done by you with devotion and dedication and that you had some idea of the sanctity of the work in which you were engaged, that is the one thing that will give you peace of mind in doing your work, and, later on satisfaction that you were invited to the festival of building up this great country and that you made your contribution, as well as you possibly could.

Dr. Radha Krishnan

Whenever you are moved by temptation to perpetrate a crime, realize the presence of God. Realize the Observer, the witness in the flesh and in the eyes of the woman for whom you crave. Realize that your Master sees you even in her eyes. My Master sees me. Act as if you were always in the presence of the Great Master, even face to face with the Divinity, all the time in the sight of the Beloved".

Swami Rama Tirtha

People who are in the second state of spiritual development, if true to themselves, live constantly under the eye of the Master. They feel and realize that wherever they may go, in the innermost chamber of the house, in the most secluded caves of the forests, they find themselves under the eyes of God, seen by Him, fed by His light, nourished by His grace.

Swami Rama Tirtha

The true end of our work is to renovate, to purify, and also to perfect the whole man by liberating his intellect, elevating his standard of duty, and developing to the full all his powers. Till so renovated, purified and perfected, we can never hope to be what our ancestors once were—a chosen people, to whom great tasks were allotted, and by whom great deeds were performed. Where this feeling animates the worker, it is a matter of comparative indifference in what particular direction it asserts itself, and in what particular method it proceeds to work. With a liberated manhood, with buoyant hope, with a faith that never shirks duty, with a sense of justice that deals fairly by all, with unclouded intellect and powers fully cultivated, and lastly, with a love that overleaps all bounds, renovated India will take her proper rank among the nations of the world, and be the master of the situation and of her own destiny. This is the end to be reached this is the promised land. Happy are they who see it in distant vision ; happier those who are permitted to work and clear the way on to it ; happiest who live to see it with their eyes and tread upon the holy soil once more, Famine and pestilence, oppression and sorrow, will then be myths of the past, and the good will once more again descend to the earth and associate with men, as they did in times which we now eall mythical.

Ranade

Labour is not being properly led and must be rescued. It is a matter of patience and sympathy. Firmness in dealing with labour agitators and in restoring discipline among labour ranks is indisputably necessary. If we cannot be firm, we might cease to govern. Government cannot allow intimidators to function with immunity. All the three parties, labour, Capital and Government, have common interests and common outlook in many a field. We must act with mutual consultation. All of us must have courage to face facts and deal with them in a practicial way. Hesitancy is out of place :

(*Contd. on page 16*)

Ginger–A Profitable Spice Crop

S. B. S. Tikka

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Ginger (Adrak) is a most important spice crop of India grown over 20,000 hectares. This is mainly cultivated in Kerela state and about 90% of the total production of this state is exported to middle east countries which earns foreign exchange amounting Rs 2.56 crores (1973-74) annually. It is also grown in other states particularly Himachal Pradesh, Madhya Pradesh, Orissa, West Bengal, Andhra Pradesh, Punjab, Gujarat and Rajasthan to meet the internal demand of the country. The ginger of commerce is green or processed underground stem 'rhizome' which is utilised in manufacture of ginger-oil, ginger-essence, oleresin, ginger-beer, ginger-brandy etc. and in a number of medicinal preparations.

A net profit of Rs 10,000/- per hectare may be obtained if high yielding varieties are cultivated under proper crop management practices.

Climate and soil

Ginger thrives well in warm and humid climate. It can be successfully cultivated in the elevation ranging from 500 to 2000 meters above sea level. Generally it is cultivated as a rainfed crop in the areas receiving very high rain-fall. Excessive rain-fall during its germination and early growth is harmful. However, heavy showers during growing period and comparatively dry weather towards its maturity period are best for its cultivation. It can also be grown in the areas receiving scanty rain-fall, if assured irrigation facilities are available. It can be cultivated on almost all well drained fertile soils. However, sandy or clayey loam, red loam and lateritic loam soils rich in humus are supposed to be best for its cultivation.

Varieties

A number of indigenous varieties are being grown in different ginger growing states of India. Among them varieties 'Khurppampadi' 'Thodipuza' and 'Mynad Monontody' from Kerela, 'Narsapthan' from Andhra Pradesh, 'Moran' from Assam, 'Dolka' from Gujarat, 'Burdwan' and 'Nadia' from Bengal and 'Wynad' from Himachal Pradesh are promising.

In addition, some of the varieties introduced from other countries are capable of giving very high yields. Variety 'Riode-Janeiro' which has been introduced from Brazil, yields as high as 170-250 Q/ha green ginger. Similarly varieties 'Ta-Kuang' and 'Chu-Chaing' from Taiwan are promising.

Sowing

The land should be ploughed 4-6 times by country plough and brought to fine tilth. Add 20 tonnes of Farm Yard Manure or compost per hectare at the time of field preparation. In the areas where crop is taken as rainfed, prepare raised beds of 1m X 6m X 15 cm dimensions. A spacing of 30-40 cms should be kept between two beds to serve as drainage channel. Sowing is done in the beds in rows spaced 25 cms apart maintaining 15 cms within row distance. Where ginger is taken as a irrigated crop, prepare ridges of 15 cms height, which should be spaced 40 cms apart. The sowing is done on the top of the ridges keeping plant to plant distance of 25 cms.

April-May is the best time of sowing for Kerela, Himachal Pradesh, Madhya Pradesh and the tarai districts of Uttar Pradesh. However, it is advisable to sow in the month of March in Tripura, Orissa and Bengal. As ginger is propagated by underground rhizomes, select carefully preserved rhizomes and cut them into small bits each weighing 25-30 gms and possessing atleast one or two healthy buds. About 12 to 15 quintals of seed-rhizome is sufficient for one hectare sowing. The seed-rhizome should be treated with ceresan 0.25% solution by dipping for 30 minutes before sowing. This prevents the attack of soft rot disease in the crop.

Mulching and aftercare

Mulching in ginger cultivation is a unique cultural operation which has definite bearing on yield. Just after sowing cover the field with thick mulch of green leaves R 10,000 kg/ha. This will conserve soil moisture, accelerate sprouting and check weed growth at the early stages of crop growth. The second and third mulching should be done during second and third month of planting. The field should be kept weed free by hand weeding as and when required. Earthing of beds or ridges should be done in the month of July and towards the last week of August.

Manuring

As ginger is a very exhausting crop, it should be well manured to get a bumper harvest. For Kerela 50 kg nitrogen, 50 kg phosphorus and 60 kg potash; for Himachal Pradesh 50 kg nitrogen, 50 kg phosphorus and 25 kg potash; for Punjab 50 kg nitrogen and 28 kg phosphorus and for Orissa 60 kg nitrogen, 40 kg phosphorus and 60 kg potash per hectare is recommended. Apply complete dose of phosphorus and half the dose of potash at the time of field preparation as basal dressing. The nitrogenous fertilizers should be given as top dressing. The first top dressing which constitutes half the dose of nitrogen and the remaining dose of potash should be done after two months of planting. The second top dressing of the second dose of nitrogen should follow after a month.

Pests and diseases

Stem borer is the most serious pest of ginger. It bores the main stem and the shoots dry-up. This can effectively be controlled by spraying the crop with 0.05% endrin or 0.08% parathion at the monthly interval for 3-4 times after second month of planting.

The crop is badly damaged by soft rot or rhizome rot caused by *Phythium sp* and *Sclerolium sp.* In the initial stage of the disease the tips of the leaves start yellowing which gradually spreads down the complete leaf. The basal part of the plant becomes soft and water-soaked. The rhizomes are decolorised, decomposed and turn blackish yellow from inside. The disease is more prevalent in the areas with poor drainage. To prevent the attack always use treated seed-rhizomes. As soon as the disease appears in the field drench the beds with chestnut compound. This compound is a mixture of Ammonium carbonate and copper sulphate (11 : 2). To prepare the solution dissolve 24 gms of the powder in 9 litres of water.

The leaf spot caused by *Colletotrichum capsici* is also a common disease. The disease is characterised by appearance of numerous small yellow spots on the surface of the leaves which turn brown and finally the leaves dry up. This can be controlled by spraying with 1% Bordeauxmixture.

Harvesting and curing

The crop takes about 8 months to mature At maturity the leaves start shrivelling, yellowing and withering. The crop can be harvested in stages depending on the local demand and market price. The harvesting may be started in the month of October and may be continued upto December. The main crop is, however, harvested in the month of November. The crop is dug with the help of spade or digging fork. Care should be taken during digging so that the rhizomes are not injured. Before marketing the green rhizomes are thoroughly washed and dried in the sun.

For making dry ginger, the rhizomes are overnight soaked in water. The outer skin of the rhizomes is peeled off with the help of sharp edges of the bamboo splits. After peeling the produce is again thoroughly washed and dried in sun for 9-12 days. After the rhizomes are completely dry, rub them with gunny bags so that the adhered dry skin is completely removed. Pack the produce in bags for sale.

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boldness is clearly indicated. But at the same time you should show understanding and sympathy to those whom you utilise as the means of production. It is only then that you can win labour round. You should educate labour into correct ways of conduct.

Sardar Patel

The form of government is after all a means to an end ; even freedom itself is a means, the end being human well-being, human growth, the ending of poverty and disease and suffering, and the opportunity for every one to live the good life, physically and mentally.

Jawaharlal Nehru

Up, lad, up, 'tis late for lying :
Hear the drums of morning play.
Hark, the empty highways crying
'why 'll beyond the hills away ;
Towns and counties woo together,
Forelands, beacon, belfries call ;
Never lad that trod on leather
Lived to feast his heart with all.
Up, lad ; thews that lie and cumber
Sunlit pallets never thrive ;
Morns abed and daylight slumber
Were not meant for man alive.

A. E. Housman

Fight Apple Scab At Proper Time

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Apple scab caused by a fungus, *Venturia inaequalis*, is a destructive disease which makes the trees unproductive and weak by mid-season defoliation. The fruits lose market value due to their deformed, scabby and knotted appearance. This disease is prevalent in almost all the countries where apple is grown and is considered to be the number one disease of apples. In India. the disease spread is limited to Kashmir Valley. The disease attack mainly confined to 'Ambri' apple was recorded in 1935, and belief had prevailed that the reasons for the irregular bearing of Ambri trees and their decline was the result of scab. Hence, the orchardists of Sophian area, where this priced variety had many trees, started replacing it with Red Delicious plants in the last 15 years or more. Red Delicious trees were proving a boon to Kashmir Valley as these were free from scab, coming into bearing within 5-6 years of plantation, and the fruit having all the attractive colour, qualities and taste for the liking of populace in India. Suddenly in 1973, there was an outbreak of the disease resulting in scabby fruits of this variety as well in many orchards of Sophian area (Anantnag Distt.). Within next two years, scab has not only spread to all the apple growing areas of the three districts (Anantnag, Srinagar and Baramula) of Kashmir Valley, but has spread to many other commercial and non-commercial varieties which were earlier free from the disease. A preliminary survey of apple market at Delhi in 1974 has revealed the continued severity of the disease on Red Delicious. The other varieties showing comparatively less severity were Royal Delicious (Starting Delicious), Ambri, Fokla, Maharaji (White Dotted Red), Kings Pippin, and Hazrat Wali (Benoni).

Question now arises as to what has led to the outbreak of this disease in Kashmir Valley. The possible reasons are sufficient inoculum (seeds of the fungus) build up over so many years coupled with favourable winter and spring conditions, large uninterrupted areas under Red Delicious and few other varieties of apple, and the neglect of proper control programme in the orchards.

Important aspect of the disease

Scab overwinters in the dead and fallen apple leaves under the trees. As the temperature rises above 10°C in late January and February, the fungus enters the sexual stage and produces pimple like structures, called perithecia (fruiting bodies) imbedded in the leaf as seen with the help of an hand lens or microscope. The mature perithecia produce ascospores (winter spores) in late winter or early spring and with the advent of spring rains, these forcibly discharge ascospores into the air, which carries them to the new green leaves and fruit buds of the apple trees around. This process may continue till June depending on prevalence of cool, rainy weather. These spores result in the formation of light brown or olive coloured spots on the young leaves and sepals. The spots soon turn to black as the fungus produces hundreds of new spores (summer spores or conidia) in each spot. The summer spores are washed down by rains and carried over from the infected portions to other healthy green leaves and to the young fruit where they start secondary infections. The spread of the disease continues with each shower of rain throughout the summer and in early fall.

Hence, the most critical period for the development of epidemic is from the time the buds start swelling until 2-4 weeks after petal full. If this spring period is cool and rainy after experiencing moderate to heavy snow cover in winter, conditions are most favourable for liberation of primary inoculum, and for subsequent infection of sepals and young leaves. A second critical period occurs in autumn, when comparatively cool, moist weather may permit severe late infection of fruit and leaves.

Suggested spray schedule for control

As the disease continues to ravage the economic value of the apple crop in Kashmir valley, and there has hardly been any work on various aspects of the disease in this country, the control strategy being suggested here has been based on the valuable findings of research work done in other countries for several decades and its judicious application in coming years is advocated. In recent years, the control measures have been aimed towards (i) the

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Why not Grow Sabour's Angar, Anal and Arun Chillies in Bihar ?

B. K. Gupta & S. Wasif Ali

The cultivation of chillies can be a paying occupation in the state of Bihar in spite of decline in its acreage in recent past. Evolution of superior varieties and better soil management interred from the trials conducted during 1958-59 to 1966-67 at Sabour, have shown encouraging results.

Chillie is one of the condiments used mostly for its pungency and spicy taste. It is also used for pickling purposes and in curry powder preparation and is extensively grown in Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka and Bihar in that order. Bihar has an area of 24-33 thousand hectares under chillies, producing on an average 15-23 thou. sand tonnes against India's total of 6 lac hectares with a production of 4 lac tonnes of dry chillies. The varieties grown here are *Rarhi, Sity, Cospurea* etc. As chilli is an indispensible adjunct to the recipes. Only 2½% to 3% of the total production of the country is exported abroad and still ranks first in World export trade. With the increase in population and external demand, there is every need to boost up the production of chillies.

The reduction in the area of chillies in the State during the last decade has been adduced to the poor and impoverished nature of the soil, heavy rainfall and waterlogging, severe attack of pest and disease, use of uneconomic varieties leading to poor returns, lawer evaluation of the produce by the intermediaries.

These handicaps have now been ameliorated by suitable soil management through application of suitable doses of fertilisers on the basis of experimentation and soil testing, by using effective modern insecticides and fungicides and selection of three early high yielding, deep red and extremely pungent varieties which can give remunerative yields.

Suitable varieties :

In Bihar, research investigations on chillies were first undertaken at Sabour in early sixties with slender achievement. Subsequently, the State Govt, sanctioned a scheme for chillies and tomato research at Agricultural Research Institute, Sabour in 1956. Under this scheme, work on evolving suitable varieties of chillies was restarted. From a large number of single plant selections from the cultivator's plots from the different tracts of the State, 10 promising strains of chillies were isolated. Further screening for a number of years led to the selection of three strains Sabour Angar, Sabour Anal and Sabour Arun as the most suitable varieties of the State. They are partially resistant to die-back and virus with very long fruit size and shining deep red pods. They are medium in maturity with a record yield varying from 1110-2420 kg of ripe and dried pods per hectare even at the cultivator's plots of Bhagalpur, Dholi and Khagaria when all the inputs of cultivation like good seed, better soil management and efficient utilization of plant protection measures were supplied. Even though as high an yield as 2500 kg of dried pods per hectare was recorded in the experimental plots at Agricultural Research Institute, Sabour, an average yield of 1100 to 1400 kg of dried pods per hectare under cultivator's condition appear to be a fair estimate.

The varieties Angar and Anal have deep red dried pods whereas Arun has shining deep red pods. In fruit size (9-1 cms to 9.8 cms) and seed percentage in dried pods (55% to 58%) they have little variations. Angar and Anal are slightly more pungent to Arun. They begin to mature from 85 days to 98 days after transplanting with little variation amongst themselves in this regard.

In order to visualise the efficacy of these experimental results, trial cum demonstration plots of 0.1 hectare in size of all these three varieties against local were laid out in the cultivator's plots in Khararia, Dholi and Bhagalpur during the year 1967-68 to 1970-71. They have shown very encouraging results. Angar, Anal and Arun were significantly superior to local varieties in Bhagalpur whereas Arun and Angar were superior to the local varieties in Dholi and Khagaria respectively. Dried

(*Contd. on page 21*)

Plant Growth Regulators on Mango

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of Annamalai University & Tamil Nadu Agriculture University

Mango—the 'King of Fruits' is being grown in India over 7.5 lakh hectare with an estimated annual production of 69 lakh tonnes. Inspite of its economic importance and increasing demand, the spread of its cultivation is adversely affected by several problems, chief among them being the irregular bearing habit, fruit drop, malformation, pests and diseases.

With a view to solve some of the problems faced by the mango growers, science has made available miracle chemicals—'The Growth regulants'. These chemicals have been found highly successful on several horticultural and agricultural crops. On mango high degree of success has been reported with regared to (i) lessening the irregular bearing tendency of mango, (ii) reduction in fruit drop and flower thinning, (iii) narrowing the sex-ratio and (iv) successful airlaying.

Fruit Drop :

It has been estimated that as much as 99% of the flowers put forth drop. This phenomenon is a continuous process which poses a problem to the growers. The drop that occurs in the initial stages can be considered to be an essential one, acting naturally, so as to reduce the competition among developing fruits. But the drop that continues after 4 weeks of flowering obviously causes concern and financial losses.

The revelation that the exertion of growth substances and cessation of their flow from other parts to the developing fruits has been attributed to be the immediate cause of fruit drop. The Table 1 gives the results of certain trials on the response of different varieties of mango to Growth Regulator for the control of drop.

Variety.	*Chemical.*	*Concentration.*	*Spray Schedule.*
Langra	NAA	10 ppm	Thrice at weekly interval
Dushert	2, 4-D	40 ppm	Single spray.
	NAA	50 ppm	Set stage and seven days after.
Faliri	NAA	20 ppm	One spray
Alphonso	NAA	25 ppm	One spray wher fruits $\frac{1}{2}''$ to $1''$ ir diametre.
Neelum	2, 4-D	30 ppm	Six weeks after fruitset

Experiments conducted at Fruit Research Station, Periyakulam showed that a single spray of (250 ppm) Alar, N6 BA (Kinin) and NAA (25 ppm) were effective in minimising the fruit drop when sprayed at set period. Ethrel at 300 ppm also reduced subsequently the drop acting as thinning agent in the initial stages.

Sex Expression :

The percentage of hermaphrodite flowers in mango is very low. In mango variation between varieties with regard to perfect flowers is more. To cite examples, the percentage of hermaphrodite flowers in a panicle is inherently low in certain varieties viz., Jehangir, Mulgoa, Salem Bangalora etc., ranging from 3 to 5 percent. This naturally leads to the poor yield of the said varieties. To improve the percentage of hermaphrodite flowers, growth regulators are being tried. Trials conducted at Calcutta University revealed that B-Nine and Cycocel (4,000 ppm) were found to be the best. The regulants were sprayed thrice on current year's shoots beginning from May. Trials conducted at Fruit Research Station, Periyakulam showed that ethrel 500 ppm. sprayed during October increase the number of panicles and percentage of hermaphrodite flowers remarkably in Alampur Baneshan, Jehangir, Mulgoa, Salem Bangalora and Chandrakaran.

Size and Quality :

From the experiments conducted at Fruit Research Station, Periyakulam on "Neelum" variety of mango had shown that large sized fruits were obtained from trees sprayed with ethrel 150 ppm during

the flowering period. Trials on "Banganapalle" variety conducted at Orissa had shown the superiority of NAA 40 ppm in increasing the size and weight of fruits. NAA @ 40 ppm has also been reported to have influenced positively the size and weight of fruits in "Banganapalle". The T.S.S. content was also enhanced. Besides NAA 40 ppm had also increased the percentage of T.S.S. Ascorbic acid and titratable acidititiy were increased by 40 ppm 2, 4-D. Similar experiments were also conducted on the Neelum Variety of mango at Fruit Research Station, Periyakulam. Sprays were given during pre-beoom stage. Fruits obtained from Kinin 10 ppm sprayed panicles were high in T.S.S. and reducing sugars followed by 2, 4-D 10 ppm. Ascorbic acid was highest in fruits obtained from kinin 20 ppm followed by 2, 4-D 10 ppm. The cost of kinin is so high that it is not feasible to try it commercially at present.

Reports from Central Food Technological Research Institute reveal that dipping mango fruits in 2,500 ppm Alar at 53°C caused an increase in both total Cartenoids (Precursor of Vit. A) and Carotene.

Storage :

Malic Hydrazide (MH) has been found to delay ripening and enhance the storage life. Trials conducted at Kalyani University, West Bengal showed that dipping fruits in MH at 500 ppm improved the storage life and quality of fruits. The same results were obtained earlier to the above work at Central Food Technological Research Institute. The efficiency of such regulators as 2, 4-D of MH was increased when used along with wax emulsion containing 1% sodium orthophenylphenate.

Air-layering :

Air-layering is the oldest and yet the current method of propagation for mango in South India. It has its limitations such as the influence of rootstock (which is normally non-descript), dependance of lower branches use of pot stands etc. Air-layering which was unsucessful resulted in grand success by the use of growth regulators. Experiments conducted at Fruit Research Station, Kodur, Andhra Pradesh revealed that the mixture of I.A.A., I.B.A., PA. (Phenyl acetic acid) and NAA was effective in including high percentage of rooting when applied at 0.25 and 0.5 percent each. Besides, the performance of the trees raised from layers was as good as grafts. Successful use of growth regulators in Air-layering has also been reported from Egypt with a mixture of I.A.A., I.B.A. at 0.25%.

Conclusion

Growth regulators have been successfully tried for combating various problems in mango. Though most of them are presently being tried experimentally. their success in experiments prove its wide feasibility of being employed in commercial culture of mango. Ethrel is one such chemical which has proved its worthiness in combating biennial bearing rhythm besides increasing the percentage of hermaphrodite flowers.

(*Contd. from page 17*)

elimination or reduction of perithecial production, (ii) prevention of ascospore (winter spore) release from host tissues, and (iii) protection against primary infection in spring by giving protective sprays of fungicides.

The following spray (Table 1) schedule which comprises of 2 sprays each of curative (eradicant) and prophylactic (protectant) chemicals is hereby suggested for adoption to effectively keep the disease under control. However, the timings, frequency, and number of sprays in each year will vary depending on the meterological conditions prevalent in different regions.

The fungicidal sprays will give satisfactory control only when these have been applied at the proper time as also interval and on long term basis for a number of years in sequence. After first and second sprays of eradicant fungicides (urea or benlate) in autumn and early spring, the third spray should be so timed as to begin just after petal fall to provide escape to the trees from primary infection. Further one or two applications should be made at 10-15 days interval to bring new infection under control. However if weather continues to be rainy in spring and summer, number of sprays should accordingly be increased.

It must be realized that while an adequate and timely spray programme will give satisfactory control of scab, haphazard spraying or spraying after the appearance of primary scab symptoms may have no effect and scab may destroy the crop despite such operations. In addition to these fungicidal

sprays, efforts must be made to maintain proper and cleaner sanitary conditions in the orchards by adopting immediate destruction of pruned material and fallen leaves, and by ploughing the orchards for removal of plant debris harbouring fungal mycelium.

Investigations on important aspects of the disease are in progress at the Indian Agricultural Research Institute, New Delhi in cooperation with local agencies.

(*Contd. from page 18*)

pods of these demonstration plots were tested for its pungency, size and seed content and were found to be superior in many of the attributes.

A perusal of the yields as compared with the all-India average yield and the average yield of the varieties grown in advanced chillies growing states like Maharashtra, Andhra Pradesh, Tamil Nadu and Karnataka shows that the potentialities of Angar, Anal and Arun for growing in Bihar are enormous. In addition Angar, Anal and Arun, if not superior, are at par with the chillies varieties grown else-where in the country. The approximate value of the dried chillies pods of these three varieties grown in the tract has been estimated locally to be nearly Rs. 1200.00 per quintal.

It is to be noted that chillie in this tract is sown in the last week of June to the first week of July in the nursery beds and transplanted a month thereafter. The first plucking of these varieties starts from middle November onwards and continues till February end. They thus take full advantage of monsoon to complete their vegetative phase and to an extent productive phase, For subsequent growth 2-3 irrigations are required depending upon the availability of winter rain.

The land which can grow chillies here changes from year to year for managerial reasons. Still Darbanga, Samastipur, Muzaffarpur, Monghyr, Begusarai and Patna account for 85.6% of the total land under chillie cultivation in the State with Samastipur leading the list. In recent years advent of flood in North Bihar has reduced its acreage considerably. With implementation of flood control measures, newer areas may also be brought under its fold. Chhotanagpur and Santhal Pargana too have potentiality to grow chillie provided two crucial winter irrigations can be arranged. These varieties are also competible for intercropping with Castor (i.e. in between two rows of Caster) with very remunerative yield as practised in most of the tracts in the State.

Marketing and Grading :

Chillie is a crop which can not be consumed by the cultivators and needs quick marketing facilities. Marketing and Grading of chillies are specialised jobs. Factors like moisture content, percentage of discoloured and damaged pods, pods without stalk, loose seeds, foreign matter etc ; have formed the basis for formulation of "Agmark" grade for chillies. Under the grade standard fixed for chillie. varieties Sabour Angar, Sabour Anal and Sabour Arun due to their fruit length (9.1 cms to 9.8 cms), colour (deep red to shining deep red) with 1% each of damaged and discoloured pods, loose seeds, pod without stalk, foreign matter, 5% broken chillies and 11.5% of moisture content in a specified sample have befitted themselves in the maximum limit of tolerance and can be graded, if not superior, at par with Rari special of the IVth schedule prescribed by the Directorate of Marketing and Inspection.

In view of these facts, varieties Sabour Angar, Sabour Anal and Sabour Arun have been released for adoption for general cultivation by the cultivators of the state of Bihar to promote the export need of the country.

(*Contd. from page 12*)

co-workers (Kaul 1970) indicated that *Eucalyptus melanophila, E. tessellaris, E. coolobah* and *E. camandulensis* to be promising for the arid regions of Western Rajasthan. Among *Acacia* species *A. tortilis* introduced from Israel has proved to be the most promising introduction. Other species of *Acacia* which showed promise were *A. victoriae, A. ligulata* and *A. aneura.* Among the species of other general *Casuarina cristata* and *Myporum monatum* (shrub) from Australia showed good performance even resisting the frost that occurred in Jan. 13-14, 1967, when night temperature dropped to -1.0°C for two hours (Kaul 1970).

The initial root habit of a given species, its ramifications and its inherent capacity for adjustment to variations in soil moisture conditions appear to be very important factors in seedling survival in the first growing season following germination. The root system characteristics of *Prosopis cineraia* seedling, however, do not have the drought escaping properties at least in the juvenile seedling stage (Bhimaya

and Kaul 1966). Studies conducted by Kaul (1970) on six-year-old plants *Tecomella undulata*, *Albizia lebbek*, *Prosopis cineria* and *Acacia senegal* (all indigenous species), obtained from direct seeding and transplanting, revealed that the transplanted plants of all the species exhibited an increased length of tap root. A comparative assessment of certain root characteristics like length of root, lateral spread of roots and top to root ratio of different species, recorded at successive stages of their growth; revealed that *Acacia tortilis* had the highest rate of growth, shoot and collar diameter.

Performance of the indigenous species such as *Prosopis cineraria*, *Albizia lebbek* and *Acacia senegal* could be enhanced by selection of seedlings of suitable age (one year old) for transplanting, planting at appropriate time (first week of July) with appropriate spacing (1.6 m x 1.6 m).

For stabilising shifting sand dunes, the indigenous and exotic species which have proved successful are *Acacia senegal*, *Prosopis juliflora* (in non-frosty locality only), *Albizia lebbek*, *Cordia rothi* and *Zizyphus jujuba* among trees, *Calligonum polygynoides*, *Cassia auriculata*, *numularia*, among shrubs and *Lasiurus sindicus*, *Panicum antldotale*, *Panicum turgidum* and *Erianthus munja* among grasses. Sand dunes afforested in this way showed wide variation in fuel yield both in respect of age of the tree and the habitat. The difference in fuel yield between the habitats followed the pattern of increase in the rainfall from west to east (Bhimaya *et al* 1967). The cost of such afforestation of shifting dunes works out to Rs 277 per hectare and the cost benefit ratio works out to 1:10.6 (Jodha 1967).

Agriculture : In arid regions, farmers are conscious of usefulness of wind screens for protecting their crops against hot desiccating winds. It has been observed that the fields protected by even the primitive type of wind breaks locally known as "matts" gave an increased yield of crops by 20% to 43% compared to the crop yields obtained from the unprotected fields (Jodha 1967). In case of unirrigated agriculture, a combination of wind strip cropping and stubble mulch is recommended, in order to protect crops against hot winds.

Considering the arid zone of Rajasthan, the total area to be irrigated by Rajasthan cannal and the exploitation of ground water will be about 11% of the area of the arid zone will ultimately remain such, where the farmers have to learn to live better and improved living conditions with natural rainfall as the major source of water (Mann 1974). To achieve this, a comprehensive programme of farm forestry and pasture management oriented towards increased animal production have to be adopted by the farmers of the region, in addition to an improved dryland crop production technology, which is applicable only in those regions receiving a rainfall of more than 300 mm.

In arid areas water is the main limiting factor for crop production. It is because of inadequacy of moisture at critical periods of crop growth that the yields are adversely affected. Adoption of farm forestry and sown pastures of perennial forage grasses, apart from providing fuel and forage to animals even during drought years, can ameliorate the economic conditions of farmers by compensating crop failures to a great extent in drought years. Tree species such as *Acacia tortilis*, and *Dalbergia sissoo* are suited for farm forestry programmes. Pastures of *Cenchrus ciliaris*, *Cenchrus setigerus* and *Lasiurus sindicus* not only give consistent forage production; but improve the organic matter status of the soils and prevent wind erosion. These forage grasses promise an average yield of 2 to 3 tons of drymatter per hectare with adequate protection by way of fencing. When properly managed these grasses can sustain as many as four sheep per hectare of pasture (Mann 1972). The data concerning the growth of lamb and carrying capacity in the case of sown and natural pastures at Jodhpur are provided in Table 1 (Chakravarty 1972).

TABLE 1

Growth of lamb and carrying capacity in the case of sown and natural pastures at Jodhpur.

Pastoral treatments	Body weight gains in lamb (kg/ha)	Carrying capacity per hectare
Sown pastures:		
(1) *Cenchrus ciliaris* and *Lasiurus sindicus*	18.3	5.0
(2) *Cenchrus ciliaris* and *Cenchrus setigerus*	26.4	
(3) *Cenchrus ciliaris*, *Cenchrus setigerus* and *Lasiurus sindicus*	22.8	
Natural pasture	13.0	1.1

These forage grasses can be made more acceptable to the farming community with an inter-cropping system resulting in the yield of some grain. Investigations carried out at the Central Arid Zone Research Institute, indicated that certain varieties of green gram such as RS4 and T44 when grown in between two rows of forage grass such as *Cenchrus setigerus* apart from giving 2 to 3 q of of pulses per hectare, are capable of enhancing the yield of forage grass by 20% to 30%, thus leading to a saving of fertiliser nitrogen to the tune of 20-30 kg per hectare (Singh, and Prasad 1975).

Although it is often said that bulk of these arid lands fall under the land capability classes considered unfit for remunerative crop production, farmers have been growing some of the adapted crop types on them and would continue to cultivate the crops, notwithstanding the recurring famines and low yield levels. Thus the task of evolving a strategy for a remunerative and stable crop production, although onerous has to be undertaken to fight the twin problems of unemployment and malnutrition and to transform the existing meagre subsistence level of farming to one of marketable surplus. An appropriate crop planning involving new remunerative crops like sunflower and castor to diversity crop production, forages, and promising varieties of traditional crops, coupled with a flexible technology of moisture conservation and fertiliser use, dovetailed to the variations in agro-meteorological conditions would go a long way in evolving an ceology cum economics based crop production technology for this region. The data set out below (Table 2) indicate the potential of increasing crop production by the improved dry farming technology developed at CAZRI. Jodhpur.

TABLE 2

Yields of principal dryland crops in Western districts of Rajasthan and at the Central Arid Zone Research Institute, Jodhpur.

Crop	Average yields (kg/ha) in arid districts	Improved crop varieties	*CAZRI yields(q/ha)* 1975 (560 mm rainfall)	1971 (263mm rainfall)
Bajra	263	HB3/NHB3-1	44.6	15.5
Moong	168	S8/M8	17.8	14.1
Cowpeas	—	FS-68	20.2	—
Sesamum	99	T13/N32	7.2	2.3
Guar	—	FS 277	17.0	4.3
Sunflower	—	EC68414/ Sunrise	14.6	6.2
Cenchrus ciliaris (forage grass)	—	No, 358	128.0	88.0
Bajra fodder	—	RSK/Chadi	462.0	240.0

In order to achieve a consistent level of production on drylands, the crop production strategy has to be modified to suit the changing weather conditions from season to season, as stated below.

A. **Steps needed to derive full benefit from a good and normal rainfall :—**

1. Run-off collection and recycling of collected water for supplemental irrigation or to grow rabi crops on conserved soil moisture.

2. Application of organic manures like F.Y.M. and suitable quantities of fertiliser nitrogen (around 40 kg N/ha) to cereals and oilseed crops. Smaller quantities of nitrogen (20 gk N/ha) will be appropriate for forage and fodder crops.

3. Covering large areas with suitable varieties of cereals, pulses, oilseeds and vegetables which would lead to high levels of production.

   Ex : Bajra — HB3
   Moong — S8
   Cowpeas — FS68
   Guar — FS277
   Sunflower — EC68414
   Castor — Aruna
   Til — T13
   Jowar — CSHI

4. Increasing cropping intensity by growing fodder crops like bajra (RSK), jowar (Merta), guar (FL277), jowar + cowpeas (Charori-1) or bajra + cowpeas (Charori-1), followed by cowpeas (FS68), moong (S8), sunflower (EC68414), or castor (Aruna) which are suited for late sowing.

5. Growing crops like *raya* (T59), safflower (A-300) or sunflowers (EC69874 or EC68414) on stored soil moisture (100 mm or more) after cessation of monsoon.

6. Establishment of perennial forage crops like *Cenchrus* and *Lasiurus* spp. and shelter belts with species like *Acacia tortilis, Azadi-*

rachta indica and *Albizia lebbek* to provide adequate insulation against wind erosion in subsequent years. Forage grasses also permit inter-cropping of pulses like moong or cowpeas without any additional moisture or nutrients.

7. Planting seedlings of fruit trees especially grafted *ber* (*Zizyphus mauritiana*) varieties such as Gola, Seb, Mundia and Jogia.

B. **Steps needed to be prepared for an abnormal season :—**

(*a*) *Normal onset of monsoon followed by long gaps in rainfall*

1. Water harvesting *in situ* and sowing crops in the interrow water harvesting system and contour furrowing, to enable the crop to tide over the long spells of drought.
2. Deep sowing with a minimum soil cover, to enable the roots to tap the moisture from deeper layers.
3. Planting grain legumes and oilseed crops in the paired row system.
4. Moderate split application of fertiliser use with placement at sowing time which will provide seedling vigour and improve the rooting pattern of crops.
5. Use of surface mulches to reduce excessive evaporation of moisture from the soil surface.
6. In the case of moderate drought spells (15-20 days duration), thinning with in row would be useful to cut down the competition for limited moisture. In case of acute and longer drought spell, thinning of alternate rows may be necessary.
7. Growing drought tolerant varieties, with suitable maturity pattern like S8 of moong and FS68 of cowpeas.
8. Use of appropriate crop mixtures and intercropping, systems:
   (a) Grass (*C. ciliaris*) + *moong* (288-8, T44, RS4)
   (b) Sunflower (EC68414) + *moong* (S-8)
   (c) *Bajra* (HB3) + *moong* (S-8)

   to cut down the application of fertiliser N, and to promote complementation with regard to moisture use.
9. Gap filling/transplanting of 20-25 days old seedlings of *bajra* in the event of occurrence of showers after drought from community nurseries.

(b) *Delayed onset of monsoon*

1. Adoption of an alternate farming strategy.
   (a) Sowing of pulse crops like moong (S8, S9, RS4) and oilseed crops like sunflower (EC68414) instead of cereal crops like bajra.
   (b) Inter-cropping of grain legumes (moong or cowpeas) in established stands of perennial grasses.
   (c) Inter-cropping of sunflower and moong.
   (d) Growing sunflower instead of sesame.
2. In case growing *bajra* is considered necessary, 20-25 days old seedlings of *bajra* may be transplanted, instead of direct seeding.
3. Use of surface mulches to cut down the evaporation of soil moisture.
4. Growing mustard (T59) and safflower (A-300), with cessation of rainfall in late September or early October, provided there is at least 80-100 mm, stored moisture in the soil profile at the time of sowing.
5. Since the intensity of rainfall is expected to be high under delayed monsoon conditions, it would be appropriate to adopt run-off collection measures and recycle the collected water for protective or supplemental irrigation.

C. **Early stoppage of rains towards the end of the season**

1. Run-off collection in the early part of the monsoon, for supplemental irrigation in the latter part of crop life cycle.
2. Growing early maturing and drought tolerant varieties,

   Ex : Bajra — New HB3-1
   Moong — S-8
   Cowpeas — FS68
   Sunflower — EC68414 or EC69874
3. Growing sunflower instead of *til*.

4. Inter-cropping of grasses (*Cenchrus* spp.) and pulses like *moong* (RS4, T44, 288-8) which facilitate appropriate moisture use.

5. Use of surface organic mulches like *bajra* husk @ 4-6 tonnes/ha.

Due to the absence of monsoon in *rabi* and spring seasons, unirrigated agriculture is hardly possible in Western Rajasthan. Crops like wheat and chillies with high water requirements, and cultivated in restricted patches with assured irrigation facilities. Due to the lack of adequte irrigation resources, a tremendous cost involved in lifting water and salinity of irrigation water, these crops cannot be cultivated on vast areas. Thus the objective should be to maximise the production per unit of water. The investigations carried out at the Central Arid Zone Research Institute indicated that *Raya* (mustard) and safflower crops can be grown successfully with 2 irrigations and 30 kg N/ha to harvest 15 q and 6 q of grain respectively per hectare, unlike wheat which requires 8-10 irrigations and 100 kg N/ha. Varieties RYSR, BR40 KB1 and T59 of mustard and 7-13-3 and A-300 of safflower are promising in this regard. With these varieties it would be possible to cover large areas and thus economise the irrigation water.

Maximisation of agricultural production in the arid lands requires, organic recycling and enhancing the efficiency of applied nitrogen for crop production, in addition to maximising the output per unit of water. So, apart from introduction of perennial grasses like *Cenchrus* and *Lasiurus* species to improve the soil structure and organic matter content, it would be imperative to intensify the cultivation of legume strains which are not only efficient producers, but efficient nitrogen fixers. Studies carried out at the Central Arid Zone Research Institute, indicated that a wide variability exists among *moong* (*Vigna radiata*) varieties for N-fixation. For example strains M10 (mutant of RS4) and Madira varieties of moong were found to fix much more quantities of nitrogen than many other varieties. Use of such plant types of grain legumes in inter-cropping and including them in suitable crop rotations would bring about economy of fertiliser nitrogen to a great extent.

Cold desert : In addition to hot desert, we have cold desert in Ladak region of Jammu and Kashmir, which occupies an area of 70,000 sq. kms- with a population of about one lakh. In this area, extreme aridity, combined with low temperatures limits plant growth. High altitude afforestation with tree species such as *Salix alba, S. fragilis, Populus alba* and *P. ciliata*, rate herbs and medicinal plants would be appropriate for this region. For increasing agricultural production in the cold desert quick growing and short duration cereals, oilseeds and fodders are of great importance. Specialised animals like Pashmina goat offers unique opportunities for animal production.

Despite the preponderance of adverse agroclimatic conditions on the arid lands, the desert capabilities can be exploited by evolving an integrated technology of afforestation, grass land and pasture management and crop production, oriented towards maximising production per unit of water, based on the land capability classes. This challenging and onerous task, involves participation of not only research workers, but trained and dedicated extension workers, administrators and local population. Thus it would be appropriate to handle this complex problem based on a national plan for amelioration of arid conditions.

Chief Ministers' Conference

The following is a resume of the conclusions and recommendations arising from the two-day Conference of Chief Ministers, which concluded at New Delhi on 6th March 1976.

I. Implementation of Ceiling Laws and Distribution of Surplus Land and Compilation of Land Records

The Chief Ministers recommended that :

1. The State Governments may examine measures to set right such deviations from the national guidelines as exist in their land ceiling laws, remove whatever other deficiencies there may be and clarify such vaguenesses as exist in these laws so that the scope for challenging them in the courts of law is restricted. Specially the deviations relating to exemptions from the ceiling, payment of amount (compensation) in lieu of the acquisition of surplus land and the composition of the family that qualifies for holding land within the ceiling may be set right.

2. Steps may be taken immediately to include in the Ninth Schedule to the Constitution such land ceiling laws as have not so far been included. Since inclusion of laws in the Ninth Schedule requires amendment to the Constitution, it cannot be resorted to too often. The States may examine in details the deficiencies that exist in their laws, the fresh provisions that they would like to make in the light of the experience gained in implementation and take suitable measures for streamlining their laws and the rules at a time, thereby obviating the need for two frequent amendments to the laws to be effectively applied and included in the Ninth Schedule.

3. The Government of India together with the State Governments may examine further constitutional and legal measures necessary to insulate land reform laws from judicial review.

The State Governments may take effective steps consistent with their authority to have quickly disposed of such writ petitions as have been pending in the High Courts from before the inclusion of the ceiling laws in the Ninth Schedule to the Constitution.

4. The Government of India may consider legal measures necessary for severely restricting, if not altogether dispensing with benami transactions in land and other forms of property as legal transactions.

5. The State Governments and the Union Territories may take suitable measures for strengthening the administrative and judicial machinery keeping in view the volume of work and the time scheduled worked out for implementing the land ceiling laws. For this purpose, adequate financial provisions may also be made.

6. Wherever the laws already do not so provide, suitable provisions may be made to ensure that the title to the land is transferred to the allottee immediately after its allotment without prior payment by him of any amount payable for the allottment.

7. The Ministry of Agriculture will further examine the procedure followed by the States and the Union Territories for the implementation of the land ceiling laws with a view to simplifying them and making them more effective. In so doing it may assist the States and the Union Territories in exchanging relavent information so that they can benefit from each other's experience. The States may specifically adopt the following suggestions for the simplification of the procedure.

(a) The prescribed authority or tribunal responsible for implementation of the ceiling laws may be set up at levels not higher than the Taluka or the Tehsil and their number determined according to their work load.

(b) In States where the verification of returns has to be done in large numbers, the necessary administrative machinery at the field level may be strengthened.

(c) As far as possible the prescribed authority or tribunal may be required to scrutinise the returns and determine the surplus land by visit to the village or a group of villages on the Maharashtra pattern.

(d) The appearance of pleaders in the proceedings before the prescribed authority or the tribunal may be barred.

(e) Appeals and revisions against interlocutory orders may be severely curtailed.

(f) The time allowed for filing appeals and revisions may be reduced to not more than 30 days.

(g) Revisionary power may preferably be given to the Divisional Commissioners or the Board of Revenue.

(h) In order to discourage appeals on frivolous grounds provision may be made for the appellant to deposit a certain amount of money before filing the appeal. In the event of the failure of the appeal, the appellant may be made to pay damages for the period he remained in occupation of the surplus land.

8. Wherever the laws do not provide for imprisonment as penalty for land-owners who fail to furnish returns or furnish wrong returns, provision accordingly may be made. Provision may also be made that no compensation will be paid for a specified part of the surplus land of such land-owners. Alternatively, the law may provide for reduction in the permissible area of such land-owners. Effective steps may be taken for enforcement of these provisions.

9. Suitable monitoring and evaluating machinery may be set up by the State Governments at the district and State levels.

10. Sample surveys and random checking on-the-spot may be undertaken as part of monitoring effort by the State Governments for ensuring that the beneficiaries are actually given possession of surplus agricultural land and house-sites and necessary entries made in their favour in the record of rights.

11. (a) The provision under the Central sector scheme for giving short-term and long-term assistance to the allottees of surplus land may be supplemented by efforts on the part of the State Governments, commercial banks and other public credit institutions.

(b) In areas not covered by other Central sector schemes like the SDFA, MFAL, DPAP and CAD, the allottees of surplus land may be given the same benefits as are admissible to small and marginal farmers covered under these schemes.

(c) A small Committee consisting of the Finance Minister, the Minister of State for banking and a few Chief Ministers in association with the other concerned Ministries of the Government of India, may examine depth the problem of availability of credit to the weaker sections of the society, particularly the allottees of surplus land and come up with specific suggestions before the end of this month. It may particularly suggest simple procedure for quick supply of credit.

12. The Chief Ministers reaffirmed that except where there are serious legal hurdles, the implementation of the land ceiling laws will be completed by the 30th June, 1976.

13. (a) *Recording of rights of tenants etc.*: Special laws may be enacted wherever necessary for recording the rights of tenants, sharecroppers and other insecure holders without waiting for the completion of the resurvey and resettlement operations. The legislation may also provide for periodic updating of such record of rights.

(b) Wherever such legislation already exists, steps may be taken for shortening the prescribed procedure for the preparation and updating the record of rights.

(c) *Mutation*: Wherever statutory provision does not exist for mutation proceedings, suitabie provisions may be made. Special steps may be taken for clearance of pending mutation cases and suitable administrative arrangements made for their timely disposal in future.

(d) *Resurvey and Resettlement*: The procedure for resurvey and resettlement operations are at present long and complicated. The relevance of these procedures with a view to curtailing them as far as possibie needs to be gone into. A small group consisting of the Chief Ministers may examine practical methods of preparing record of rights expeditiously. It can specifically examine how consolidation of land holdings can be taken up in the areas where it has not yet been started.

14. Legislation may be undertaken for restortation to the village community, the panchayat the gaon sabha, as the case may be, of illegally occupied communal land. Steps may be taken to ensure that land belonging to the village community

is utilised to the extent necessary for the purposes of the community. It is only if land in excess of these requirements is available, should it be distributed to eligible individuals for cultivation and construction of houses.

15. Forest land should not usually be allotted for the purpose of cultivation. Every effort should be made to preserve forests and wherever necessary, such land should be used for afforestation.

16. The State Governments may take necessary steps for associating at the operative levels representatives of the people, social organisations, the tenants and the share-croppers and especially the beneficiaries of the land reforms programme who can supplement the efforts of the administrative machinery. It is necessary also to involve in this process the local people in general. This alone can make available the intimate and detailed knowledge of the local conditions so indispensable for effective implementation. Important steps have already been taken in involving people in the process of land reforms and rural reconstruction. This trend needs to be maintained and accelerated so that popular participation in all the processes of development becomes a reality. Only this can ensure that the benefits of the 20-Point Economic Programme reach the people for whom it has been drawn up.

II. Provision of house sites for landless and weaker sections

1. (a) The State Government and the Union Territories may so amend their laws as to provide for confirment of full ownership rights on homestead tenants in the light of guidelines issued by the Government of India wherever such legal provisions do not exist.

(b) A time-bound programme may be taken up for this purpose.

2. Provisions may be made for enforcement of ownership rights on homestead dwellers, as distinct from homestead tenants, in respect of the land under their occupation.

3. Steps may be taken to provide house-sites to every landless agricultural labourer, village artisan etc. in the rural areas by distributing surplus land, land otherwise available with the State Governments and the gaon sabhas as well as by acquisition of land wherever necessary. As far as possible, house sites should be provided in areas contiguous to the villages.

4. Action may be initiated by the State Governments for helping the families who have been allotted house-sites in the construction of huts within their means.

III. Urban land ceiling

Initiating the discussion the Minister for Works & Housing explained the objectives of the Act and outlined its broad features. He pointed out that it was desirable that there was a uniform legislation on the subject. Hence this legislation should be adopted very early by the States to which it did not apply as yet. This would enable its smoother implementation. There were certain provisions of the Act which could be implemented on the basis of information made available to the competent authorities in respect of properties held by the same person in different areas. Such a purpose could be achieved only if the law was made applicable throughout the country. The Minister further pointed out that it was not the intention of the Government that the building operations should come to a halt nor that the building plans should not be sanctioned. He appealed to the Chief Ministers to ensure that with sufficient safeguards, normal activities in these respects went on as usual.

He also referred to the problems posed by the inclusion of the peripheral areas falling in one State with the urban agglomeration of a neighbouring State, and stated that the matter would require to be examined.

Mention was made by some of the States on the need to simplify the procedure on the implementa- of the Act and also to see that the purposes of the Act were achieved in the broader socio-economic context for which the 20-Point Economic Programme was launched. Reference was also made to examine the feasibility of integrating the vacant Urban Land taxation system, as contemplated in the Act, into the general taxation system in the country specially Wealth Tax. Certain anomalies were pointed out in the existing provisions of the Act, specially those relating to the areas defined under the Urban agglomeration and the problems which the periphery concept in the schedule will bring to demarcating the operational area of the Act.

The need for overall town planning measures for proper utilisation of the excess land vested in the Government was appreciated in the meeting. The schemes for housing, specially for the economically weaker sections, needed to be taken up on a large scale.

Some of the States which have already passed legislations imposing a ceiling on urban property enquired whether President's assent which has not so far been given, would be given. It was clarified that as these legislations were not in conformity with the National Policy now adopted, the States would have to reconsider the matter. In this connection some of the States also referred to the possibility of extending the scope of this Act to towns below one lakhs of population since in some of these States, the present Act would have only a marginal or no applicability. On this point it was clarified that the matter would be further examined and it was felt that if such a modification was called for, it would be considered at the time of amending the act.

A feeling was expressed in the Conference that a specific time limit should be fixed for the disposal of cases by the Urban Land Tribunals.

In the end the Minister requested the State Governments to give their detailed suggestions regarding the difficulties that might be experienced by them in the implementation of the Act as also other suggestions for improvement of the Legislation so that these could be considered by the Government of India before moving further in the matter.

IV. Rural Indebtedness

As a result of various measures taken for liquidation of rural indebtedness, loans from the non-institutional sources are not forthcoming. Commercial Banks, Regional Rural Banks and the co-operatives should be geared up to fill in this credit gap. These institutions should also liberalise their lending policies to meet the more important consumption requirements of the beneficiaries of these measures.

V. Minimum wages for agriculture workers

The action taken since the announcement of the 20-Point Programme in regard to revision of minimum wages for agricultural labourers and its implementation was reviewed. While recognising and emphasising the need for effective implementation of the rates of minimum wages fixed or revised, the Conference agreed that the penal provision should be made more stringent and if necessary some of the violations made cognisable, with adequate safeguards against harrasment.

VI. Bonded Labour

The importance of undertaking survey for identifying bonded labourers was emphasised. In this regard it was pointed out that help may be sought from the Scheduled Castes and Scheduled Tribes Commissioner and also from Tribal Research Institute who have the requisite expertise. The Conference endorsed the suggestion that in preparing State plans adequate provisions be made for the rehabilitation of emancipated bonded labourers.

VII. Schemes of workers participation in industry

The position regarding implementation of the scheme for workers participation in industry was reviewed. It was stated that the response from the Central Public Sector Undertakings had been enthusiastic. The scheme has been introduced in 47 undertakings. However, the response from private sector undertakings had not been so encouraging. The scheme being highly flexible in nature, it was felt that employers could be pursuaded to adopt it in greater measures. The Conference endorsed the suggestion that matters which have a bearing on the improvement in the performance of the undertaking should be allowed to be discussed even though they might not have found specific mention in the scheme.

VIII. Apprenticeship Scheme

Regarding the implementation of the apprenticeship scheme, it was noted that in almost all the States the targets had been achieved. It was agreed that special steps would be taken by the States where there were some shortfalls to reach the target of filling all the located seats. A suggestion was made that a provision should be made making it compulsory for the employers to absorb the trained apprentices in employment. It was agreed that in the first instance the matter might be discussed with the employers in the State Apex Bodies.

IX. National permit scheme for road transport

The two-day Chief Ministers' Conference reviewed the progress regarding implementation of the National Permit Scheme. Since the problem of

Contd. on page 30

Unprecedented Advances in Agricultural Production

Some of the most spectacular advances in agricultural production in the world have been witnessed in India in the last decade.

The doubling of wheat production in the first half of this decade has no parellel anywhere. As against the averagc annual production of 11 million tonnes in the first half of the sixties, the wheat output reached the level of over 26 million tonnes in in 1971-72.

The total foodgrains production which was 89.4 million tonnes in 1964-65 reached the level of 108 million tonnes by 1970-71 and is set to reach 114 million tonnes in 1975-76.

From a long-term point of view what is even more significant is that the degree of fluctuation between bad and good weather years has been brovght down substantially. For instance, during the Third Five Year Plan and the three Annual Plans periods ending with 1968-69; foodgrains production fluctuated between 72 and 94 million tonnes but in subsequent years, it ranged between 95 and 108 million tonnes during the Fourth Plan period. The production fluctuation has been further brought down in the subsequent years with the result that even though the country faced unprecedented droughts between 1972-73 and 1974-75, the production did not go down below a little less than 100 million tonnes.

Indeed, a production potential has been built up which can help the country to meet all its needs of foodgrains from internal production in a year of normal weather as has been proved in 1975-76.

Commercial Crops

Equally spectacular have been the results achieved in crops other than foodgrains.

From an importer of cotton, India has become a net exporter of cotton. The production of cotton rose from 4 million bales in 1965-66 to 6.69 million bales in 1974-75.

Jute production grew from 4.5 million bales to 6.56 million bales in 1973-74.

The production of sugarcane in terms of gur, reached its highest level of 14.4 million tonnes in 1973-74 and that record was maintained in 1974-75 also.

New Strategy

These achievements have been made possible by the New Strategy adopted at the beginning of the decade. This strategy emphasised the increasing application of science and technology and included, among its key elements, the provision of better varieties of seeds, better soil and water management, multiple cropping, adequate supply of fertilisers, widespread plant protectiion measures and building up of an infrastructure for credit, marketing, training and research. All these, together with the skill, innovative spirit and hard work of the vast masses of Indian farmers, whose intimate involvement was an integral part of the new strategy, have put India on the firm road to self-sufficiency not only in foodgrain but also in several other major crops.

Contd. from page 29

Octroi was related to the question of speeding up the movement of vehicles, the Conference agreed to the setting up of a Group consisting of the Chief Ministers of some States and the Central Ministers concerned to go into the matter and make recommendations for solving it from a broader point of view.

X and XI. Essential commodities and books etc. for students

The progress relating to the supply of essential commodities to students hostels and supply of books and stationery to students at reasonable rates was reviewed by the Conference this morning. It was revealed that during the last 8 months, 2775 college and university hostels serving 2,31,317 students hostelers have been benefited as a result of supply of essential commodities, particularly through the co-operative institutions. The average monthly saving of mess charges per student has been between Rs. 10 and Rs. 15 per mensem. There has been tangible reduction in price of text-books during this period and the prices of students' notebooks and excercise-books have also registered reduction, especially because of the supply of concessional paper. With the assistance of University Grants Commission, 899 Book Banks have been opened in colleges and universities during the period under review. 74587 Book Banks have since been opened in schools.

खाद्य तेल समस्या का पूरक–सूरजमुखी

राजेन्द्र सिंह एवं डा० शिव सागर सिंह

हमारे देश में कृषि योग्य भूमि के लगभग १० प्रतिशत भाग में तिलहनी फसलों को उगाया जाता है। इससे प्राप्त पैदावार से खाने के तेल की आकश्यकता पूरी नहीं हो पाती क्योकि जनसख्या की वृद्धि के कारण आवश्यकता में निरन्तर वृद्धि होती जा रही है। इस आवश्यकता की पूर्ति के लिए हमें विदेशों से आयात का सहारा लेना पडता है। उपलब्ध आँकड़ों के अनुसार देश में खाने के तेलों की आवश्यकता ६ प्रतिशत प्रतिवर्ष की दर से बढ़ रही है। जबकि तिलहनों की पैदावार केवल ३·५ प्रतिशत की दर से बढ़ रही है। अगर यही स्थिति रही तो वर्ष १९७५ के अन्त तक खाद्य तेल का अभाव लगभग ६ लाख टन अर्थात २० प्रतिशत बढ़ जायेगा। अतः खाद्य तेल की इस समस्या को हल करने और बहुमूल्य विदेशी मुद्रा को बचाने के लिए तिलहनी फसलों में एक नया नाम जुड गया है —सुरजमुखी।

सूरजमुखी में ४५-५० प्रतिशत तेल होता है। इसका तेल खाने के काम में आता है। यह पौष्टिक एवं सुपाच्य होता है। इसके तेल से अच्छी सुगन्ध आती है। इसका रंग हल्का, पीला होता है। काफी समय तक रखने पर इसका तेल खराब नहीं होता है। भोजन पकाने, प्रसाधन के रूप में, साबुन बनाने और बनस्पति घी आदि बनाने में भी इसका उपयोग किया जा सकता है।

वैज्ञानिक अनुसंधानों से सिद्ध हो गया कि 'लिनीलोइक' अम्ल से रक्त में कोलेस्ट्रेरोल नामक पदार्थ की मात्रा कम हो जाती है, जिससे रक्त-परिवहन सम्बन्धी और हृदय रोग कम होते हैं। सूरजमुखी के तेल में 'लिनोलीइक' अम्ल की मात्रा अधिक होती है, अतः खाने के लिए यह उत्तम तेल है।

इस फसल की कुछ मुख्य विशेषतायें हैं जैसे, कम समय में पकना, दिनों की लम्बाई का प्रभाव न पड़ना, सूखा सहन करने की क्षमता अधिक होना इत्यादि। इन कारणों से इसकी खेती देश के अधिकांश क्षेत्रों में पूरे वर्ष भर की जा सकती है और मिश्रित खेती में इसका महत्वपूर्ण स्थान है।

इन विशेषताओं को ध्यान में रखते हुए भारत के खाद्य एवं कृषि मंत्रालय द्वारा सूरजमुखी की खेती को प्रोत्साहन दिया जा रहा है। परन्तु एक नई फसल होने के कारण इसकी खेती को वैज्ञानिक विधियों से अभी हमारे कृषकगण अनभिज्ञ हैं। इसलिये इस लेख में इसकी उन्नत खेती की विधियों पर प्रकाश डाला गया है।

जलवायु

जैसा कि पहले बताया जा चुका है कि इस के पुष्पन पर प्रकाश की अवधि का कोई प्रभाव नहीं पड़ता इसलिए वर्ष में इसकी खेती कभी भी की जा सकती है। भारत में लगभग हर जगह इसकी खेती ठंडे और गर्म, दोनों ही मौसमों में सफलता पूर्वक ली जा सकती है। अधिक आद्रता तथा साथ में लम्बे समय तक बादल घिरे रहने जैसा मौसम उपज पर प्रतिकूल प्रभाव डालता है।

मिट्टी :

सूरजमुखी की खेती के लिए दुमट और मटियार-दुमट भूमि अच्छी सिद्ध हुई है। जिस खेत में इसकी खेती करना हो उसका जल निकास उत्तम होना चाहिए क्योंकि पानी इकट्ठा होने से फसल पर प्रतिकूल प्रभाव पड़ता है। कम उपजाऊ भूमि में भी उर्वरक, पानी का उचित प्रबन्ध करके इसकी खेती सफलता पूर्वक की जा सकती है।

भूमि की तैयारी

सूरजमुखी के लिए भुरभुरी, खरपतवार रहित तथा उपयुक्त नमी युक्त खेत की आवश्यकता होती है। अतः बुआई से पहले एक बार मिट्टी पलटने वाले हल से गहरी जुताई करके २-३ बार हैरो चलाना चाहिए। प्रत्येक हैरो के बाद पटेला देना लाभदायक रहता है। यदि मिट्टी में नमी की उपयुक्त मात्रा न हो तो पलेवा देकर भूमि की तैयारी शूरू करनी चाहिए।

उर्वरक

अच्छी उपज प्राप्त करने के लिए संतुलित मात्रा में उर्वरकों को देना चाहिए। उर्वरकों का प्रयोग मिट्टी के परीक्षण के आधार पर करना चाहिए। यदि किसी कारण वश मिट्टी का परीक्षण सम्भव न हो तो सामान्य भूमि में ८० कि० ग्रा० नाइट्रोजन, तथा ६० कि० ग्रा० फास्फोरस तथा ४० कि० ग्रा० पोटाश प्रति हैक्टर की दर से डालना चाहिए। उन क्षेत्रों में जहां इसकी खेती असिंचित दशाओं में की जाती है वहां उर्वरकों की मात्रा आधी ही डालनी चाहिए।

उर्वरकों के देने की विधि

सिंचित दशाओं में ली जाने वाली फसल में नाइट्रोजन की आधी मात्रा, फास्फोरस तथा पोटाश की पूरी मात्रा अन्तिम जुताई के समय भूमि मे मिला देना चाहिए। शेष नाइट्रोजन की मात्रा पौधों पर मिट्टी चढ़ाते समय देनी चाहिये। उर्वरकों

को कूड़ों में ८-१० सेमी० की गहराई तथा बीज को पंक्ति से ४-५ सेंटीमीटर की दूरी पर डालना चाहिए।

बोआई का समय

यद्यपि सूरजमुखी की खेती वर्ष भर की जा सकती है। परन्तु परीक्षणों के आधार पर यह सिद्ध हो गया है कि रबी में नवम्बर—दिसम्बर, जायद में जनवरी के अन्तिम सप्ताह से लेकर फरवरी के अन्तिम सप्ताह तक तथा खरीफ में जून-जुलाई में बोआई करने से अच्छी उपज मिलती है। उत्तरी भारत में इसकी खेती रबी तथा दक्षिणी भारत में खरीफ में करने से अच्छी उपज मिलती है।

बीज दर :

एक हैक्टर की बोआई करने के लिए ८-१० कि०ग्रा० बीज पर्याप्त होता है।

बोआई की बिधि :

पंक्ति से पंक्ति की दूरी ६० से० मी० से ८० से० मी० रखनी चाहिये। परीक्षणों से पता चला है कि पंक्ति से पंक्ति की दूरी अधिक रखने के कारण पौधों की बढ़वार तेजी से होती है और खरपतवार की समस्या नहीं रहती। बीज से बीज की दूरी २० से० मी० रखनी चाहिये। बोआई से पहले यदि बीजों को पानी में भिगो लिया जाये तो जमाव सरलता से तथा जल्दी हो जाता है।

बोने की गहराई :

सूरजमुखी के बीज में नमी का प्रवेश अपेक्षाकृत धीरे-धीरे होता है क्योंकि इसका छिलका मोटा होता है और इसी कारण अन्य धान्यों की अपेक्षा इसके अंकुरण में भी अधिक समय लगता है। हाइपोकोटील के लम्बे होने के कारण इसका बीज अधिक गहराई से भी अंकुरित हो सकता है किन्तु कम गहराई अधिक उपयुक्त रहती है। गो० ब० पन्त कृषि एवं प्रौद्योगिक विश्वविद्यालय पन्तनगर में किये गये परीक्षणों के आधार पर बीज को ४ से० मी० की गहराई पर डालना चाहिए।

बीजोपचार :

सूरजमुखी का सदैव प्रमाणित और दवा मिला हुआ बीज प्रयोग में लाना चाहिये। एक किलो बीज में ३ ग्राम डाइथेन-एम-४५ या कैप्टान मिलाना चाहिये।

उन्नत किस्में :

विनिम्क-८६३१, पैरोडोविक, आर्मावर्ट्स, अर्मावरस्किज और सनराइज सूरजमुखी की कुछ उन्नत किस्में हैं। ये किस्में देश के विभिन्न भागों में सफलतापूर्वक उगाई जा सकती है। इन किस्मों की विशेषतायें सारणी १ में दी गई है।

सारणी- -१

सूरजमुखी की उन्नत किस्मों का विवरण

किस्म	गुण	पकने की अवधि (दिनों में) खरीफ	रबी	जायद	तेल की मात्रा प्रतिशत
विनिम्क	८६.३१ लम्बी	६०.१००	१२५.१३५	११०.१२०	४५
पेरोडोविक	देर से पकने वाली	६०.१००	१२५.१३५	११०.१२०	४५
अर्मावरस्किज	,,	६०.१००	१३५-१४५	११५.१२५	४५
लर्मावर्ट्स	छोटी, देर से पकने वाली	८०.६०	१०५-१२०	१००-११०	४५
सनराइज	मध्य पकने वाली	८५-६०	११५-१२५	१०५-११५	४०-४५

सूरजमुखी की जातियों के लिए उपयुक्त क्षेत्र, मौसम सारणी—२ में दिया गया

सारणी—२

मौसम	उपयुक्त क्षेत्र	उन्नत किस्में
१. खरीफ	१. मध्य भारत तथा महाराष्ट्र, मध्य प्रदेश, गुजरात तथा राजस्थान के निकटवर्ती क्षेत्र और बुन्देलखण्ड क्षेत्र।	ई. सी. ६८४१३ या महाराष्ट्र और ई. सी. ६८५१४ मध्य प्रदेश के लिए ई. सी. ६८४१५ गुजरात,राजस्थान और
२. खरीफ	दक्षिण भारत, राइचूर (मैसूर), कोयम्बटूर एव सालेम (तामिलनाडु)	ई. सी. ६८४१५
३. रबी	३. महाराष्ट्र का कोल्हापुर एवं जलगांव क्षेत्र।	ई. सी. ६८४१५
	उपयुक्त क्षेत्र	उन्नत किस्में।
	४-जिला अहमदाबाद (गुजरात)	ई. सी. ६८४१३
	५-उत्तर प्रदेश	ई. सी. ६८४१३ तथा सनराइज सेलेक्शन
	६-पश्चिम बंगाल	ई. सी. ६७४१४ (शेष पृष्ठ ३६ पर)

धान में घास-पात कैसे रोकें ?

अच्युता नंद दुबे

केन्द्रीय चावल अनुसंधान संस्थान, कटक (उड़ीसा)

धान की खेती दो विधियों से की जाती है। एक तो रोपण विधि और दूसरी खेत में सीधी बोवाई सूखी तथा कादो की गई भूमि में छिटकवां अथवा सीधी पंक्तियों में की जाती है। हम पाते है कि इन दो प्रकार से तैयार खेत में खरपतवार की विभिन्न प्रजातियां प्रधान रूप से आती हैं और फसल को हानि पहुंचाती है। कादो की गई भूमि में प्रायः साईप्रस प्रजाति (सेज) डाईकाट तथा पानी वाले विभिन्न खरपतवार उगते हैं जबकि सूखी भूमि में प्रायः ग्रेमिनी प्रजाति तथा कुछ डाईकाट और साइप्रस प्रजाति जैसे साइप्रस रोटंडस आदि खरपतवार उगते हैं और अपना प्रभुत्व खेत में जमाकर फसल की वृद्धि तथा उपज में भारी कमी पहुंचाते हैं। अतः खरपतवार द्वारा उपज में कमी को दूर करने का भरसक प्रयास करना आवश्यक है। यहां कुछ निम्नलिखित संबंधित सुझाव दिए गए हैं जिन्हें अपनाकर किसान भाइयों को अपने खेत से खरपतवार दूर करने का प्रयास करना चाहिये।

(१) रोपण विधि से उगाए जाने वाले खेत की भली-भांति जुताई और कादों करने से यह पाया जाता है कि बहुत से खरपतवार नहीं आ पाते। उगे हुए खरपतवार खेत में दब कर सड़ जाते हैं किन्तु ऐसे खरपतवार जिनमें बीज बन गया हो और पककर खेत में झड़ने वाले हों उन्हें खेत में जुताई करके मिट्टी के अन्दर दबा देने से यह परिणाम मिलता है कि फिर अनुकूल परिस्थिति पाकर बीज जमने लगते हैं और बहुत संख्या में उत्पन्न होकर खेत में एक समस्या बन जाते हैं अतः खरपतवार के नियंत्रण में ऐसे उगे हुए और पकने वाले खरपतवारों को या तो रासायनिक औषधियों से नष्ट कर देना चाहिये अथवा उन्हें उखाड़कर खेत में ही जला देना चाहिये ताकि उनके बीज खेत में नई बशावली न उत्पन्न कर सकें। इस महत्वपूर्ण बात का ध्यान खेत की जुताई के पहले रखना आवश्यक है।

(२) वर्षा ऋतु में सूखी भूमि पर जहां धान की सीधी बोवाई करनी है खेत की तैयारी के बाद ४-५ दिन तक खेत को ऐसे ही बिना बोए छोड़ देना चाहिए और खरपतवारों को पूर्ण रूप से पहले उग आने का मौका देना चाहिये। हम देखेंगे कि सारे खरपतवार इस बीच निकल आयेंगे और उनके ऊपर ग्रेमक्सोन की २ किलो क्रियाशील मात्रा प्रति हेक्टर की दर से पानी की उपयुक्त मात्रा में घोल बनाकर छिड़क देना चाहिये। इससे सारे खरपतवार झुलस कर मर जायेंगे। चूंकि ग्रैमक्सोन धान की फसल के लिए हानिकारक है इसलिए इसका प्रयोग फसल बोने के पूर्व खेत में करना चाहिए। यह सूखी भूमि पर उगे सभी ग्रैमिनी और डाईकाट प्रजाति के खरपतवारों को मार डालता है। इसके बाद खेत को एकबार फिर जुताई करके और भूमि समतल बनाकर धान की बोवाई छिटकवां अथवा पंक्तियों में जैसे करनी है, कर देनी चाहिये। यह एक आसान और बहुत उपयोगी तरीका है जिससे खेत से खरपतवार का पूर्ण अथवा बहुत हद तक नियंत्रण किया जा सकता है।

ऐसे किसान भाई जो रासायनिक औषधियों के खर्च को नहीं सहन कर सकते और अपने घरेलू श्रमिकों से ही काम चलाना चाहते हों उनके लिए फिर यह सुझाव अपेक्षित होगा कि कुछ दिन के लिए खरपतवारों की वृद्धि की प्रतीक्षा करें और खेत में बढ़ने दें। जब खरपतवार हाथ से पकड़ने योग्य हो जांय तो एक तरफ से उखाड़कर फेंक दें। इस विधि में समय तथा श्रम की अधिक आवश्यकता पड़ेगी। बुवाई के पूर्व हल द्वारा भी खेत में बढ़े हुए खरपतवारों का नियंत्रण किया जा सकता है और उन्हें मिट्टी पलटने वाले हल से जुताई करके मिट्टी के अन्दर उलटा जा सकता है ताकि सड़कर खाद बन जायें किन्तु कुछ खरपतवारों की जड़ें मर नहीं पाती और फिर पनपकर अपना पौध रूप धारण कर लेती हैं जो खेत में बढ़ते हुए धान के पौधों के साथ खुराक, पानी, प्रकाश और जगह के लिए लड़ने लगती हैं परिणाम निकलता है कि फसल इस होड़ के कारण धीरे-धीरे कमजोर पड़ने लगती है और अपेक्षित उपज नहीं प्राप्त हो पाती इसलिए ऐसे खरपतवारों की जड़ों को बीन-बीन कर खेत से बाहर कर देना चाहिये ताकि समूल उनका विनाश खेत से हो जाय।

(३) रोपी गई अथवा कादो की गई सीधी बोई भूमि में जहां सदैव पानी कायम रखा जाता है हम पाते हैं कि कहीं-कहीं बहुत जलीय खरपतवार उगकर पानी के ऊपर तैरते रहते हैं इनमें इलैटिन स्पैसिज एवं अन्य अनेक प्रजातियां और शैवाल आते हैं जो धान की नीची भूमि में जहां पानी सदैव टिका रहता है, पानी के ऊपर तैरते रहते हैं और उनके फिलामेंट पानी में लटके रहते है तथा पानी में घुलित तत्वों को शोषण करते रहते हैं। इन्हें धान की खड़ी फसल में हाथ से निकालना अथवा किसी यांत्रिक विधि द्वारा नियंत्रण करना बिल्कुल कठिन होता है अतः ऐसी परिस्थिति में पानी को बाहर निकालने और फिर पारी भर कर इस क्रिया को कई बार दुहराने से इन्हें कम किया जा सकता है। पानी की उपलब्धि की कमी अथवा वर्षा द्वारा आवश्यक पानी की प्राप्ति में जहां शंका है और किसान भाई एकबार खेत में जमे पानी को बाहर निकालना उचित न समझते हों तो ऐसो

दशा में खरपतवार नाशक औषधियों का प्रयोग करना चाहिये। इनकी उचित मात्रा तथा प्रयोग विधि की जानकारी किसी अनुसंधान अथवा विकास प्रखंड संस्थान से प्राप्त कर लेनी चाहिये। प्राय: देखा जाता है कि किसान भाई ऐसे पानी पर तैरने वाले हानिकारक खरपतवारों द्वारा पहुंचाए जाने वाली हानि को न जानकर उनके नियंत्रण के लिए परवाह नहीं करते किन्तु इनसे भी फसल को भारी हानि पहुचती है और खेत में भारी संख्या में मोटा गत्था इन खरपतवारों से बन जाने पर पौध से निकलने वाली दोजी संख्या पर बहुत कुप्रभाव पड़ता है। एक तो अधिक पानी खेत में जमा होने से धान की बौनी किस्मों की दोजी संख्या पर प्रभाव पड़ता है और दूसरे हानिकारक खरपतवारों द्वारा पानी की सतह पर मोटी चद्दर बन जाने से दोजी निकलने में कमी आ जाती है जो उपज में कमी के कारण बनते हैं। कादो करके धान खेत में सीधी बुवाई करने पर शैवाल की भारी उपस्थिति के कारण यह पाया जाता है कि बीज के अनुकूल जमाव, वृद्धि तथा कल्ले निकलने पर प्रतिकूल प्रभाव पड़ता है और शुरू से ही उपज में कमी का कारण दीख पड़ता है। अत: हमें पूर्णरूप से अन्तर्गत परिस्थिति में खरपतवार नियंत्रण पर बल देना चाहिये।

(४) धान की नर्सरी में अधिक खरपतवार के कारण अच्छी पौध नहीं प्राप्त हो पाती तथा इन खरपतवारों के कारण बहुत से रोगों तथा कीड़ों को भी आक्रमण में बढ़ावा मिलता है। फलत: पौध कमजोर पड़ जाती है। इन खरपतवारों के द्वारा पौधों की बढ़वार भी कम हो जाती है तथा पौधे दब जाते हैं जिसका प्रभाव फसल की उपज पर पड़ता है। इसलिए नर्सरी की अच्छी प्रकार तैयारी, उसकी भली भांति जुताई और बीज क्यारी का समतलपन आदि खरपतवारों की नर्सरी में कमी लाने वाली बातों पर ध्यान देना चाहिये। यही नहीं बरन शुद्ध बीजों के प्रयोग का भी भारी महत्व है जो बिना खरपतवार के बीजों से मिश्रित हों। यदि इन सब प्रयासों के बावजूद खेत में खरपतवार उग आए हों तो उन्हें रासायनिक औषधियों के द्वारा नष्ट कर देना चाहिये। हाथ द्वारा निकाई करने में इस बात का ध्यान रखना चाहिये कि धान के पौधों जैसे दिखाई पड़ने वाले ग्रैमिनी प्रजाति के खरपतवार अच्छी प्रकार बीनकर बाहर कर दिए जाये। जैसा पहले बताया जा चुका है कि खेत में बोवाई के पूर्व खरपतवारों को उगने का मौका देकर उन्हें औषधि प्रयोग द्वारा नष्ट कर देना चाहिये उसी प्रकार नर्सरी में भी वैसा ही उपचार देकर बीज की बोवाई के पूर्व खरपतवार का नियंत्रण औषधियों द्वारा कर देना चाहिये। वैसे बीज की बोवाई के बाद भी उगे खरपतवारों पर औषधि प्रयोग से इनका नियंत्रण किया जा सकता है किन्तु उस समय ग्रैमक्सोन का प्रयोग बर्जित है अत: किसी भी औषधि के प्रयोग में सदैव विशेषज्ञों से सम्पर्क स्थापित कर लेना चाहिये।

(५) धान की सीधी बोवाई जब कादो की गई भूमि में की जाती है तब कभी-कभी किसान भाई अंतिम पलेवा के समय नत्रजन तथा फास्फोरस वाली खाद खेत में मिलाते हैं किन्तु उसे भूमि में अच्छी प्रकार नहीं मिलाते। इससे यह परिणाम निकलता है कि खेत के ऊपर पानी की महीन तह पर तमाम हरित शैवाल उत्पन्न हो जाते हैं जो बीज के जमाव में बाधक सिद्ध होते हैं। अत: इस बात का सदैव ध्यान रखना चाहिये कि जब कभी कादो की गई भूमि में नत्रजन और फास्फोरस का प्रयोग करें, उसे खूब अच्छी प्रकार भूमि में जुताई करके अथवा रेक द्वारा मिला दें ताकि खेत में हरित शैवाल के अधिक उत्पन्न होने की समस्या न पैदा हो। खड़ी फसल में नत्रजन की टाप ड्रेसिंग करते समय खेत में खरपतवार नहीं होने चाहिए अन्यथा उन्हें उर्वरक के प्रयोग के बाद वृद्धि में अधिक बढ़ावा मिलेगा।

(६) भूमि का समतलपन न होना भी अधिक खरपतवार उत्पत्ति का एक कारण पाया जाता है क्योंकि खेत के किसी भाग में ऊँचाई के कारण वहां पानी नहीं टिक पाता जिससे पानी के कारण दब जाने वाले खरपतवारों को उगने और बढ़ने में सहूलियत मिलती है, यही कारण है कि खेत में कहीं कम तो कहीं अधिक खरपतवार उगे हुए दिखाई पड़ते हैं जिसके कारण खेत के सभी भाग में समान फसल नहीं दीख पड़ती। वैसे फसल चारों तरफ एक सी न दिखाई पड़ने का कारण उर्वरक की कमी भी है। किन्तु खरपतवार भी अपनी तीव्र वृद्धि के कारण अमुक स्थान की फसल कमजोर कर देते हैं और नीची भाग की अपेक्षा शीघ्र बढ़कर फसल को दबा देते हैं। खरपतवार फसल के साथ बराबरी की होड़ खुराक, प्रकाश, नमी तथा फैलाव के लिए करते हैं और फसल को कमजोर बना देते हैं।

(७) धान के खेत में फसल चक्र अपनाकर खेत में खरपतवार की संख्या में कमी लाई जा सकती है उन क्षेत्रों में जहां धान के बाद धान ही की फसल लो जाती है वहां एक फसल के बाद दूसरी ऐसी धान की फसल चुननी चाहिए जिनमें अधिक कल्ले की वृद्धि की क्षमता हो, पत्तियाँ लम्बी हों जो आने वाले खरपतवारों को प्रकाश प्राप्ति में बाधा पहुंचाए, तने मोटे और मजबूत हों तथा पौधों में बाढ़ एवं जड़ विकास की क्षमता तीव्र हो ताकि खरपतवार के साथ फैलाव, जमीन में शीघ्र वृद्धि और खुराक प्राप्ति आदि सभी दृष्टियों से मुकाबला कर सकें। केन्द्रीय चावल अनुसंधान पर बाला किस्म में ऐसा गुण पाया गया है और एक प्रयोग द्वारा अनेक उन्नतशील किस्मों के मुकाबले बिना खरपतवार नियंत्रण के अधिक उपज प्राप्त की गई है। अत: इस प्रकार की महत्वपूर्ण बातों पर भी किसान भाइयों को चुनाव में ध्यान देना चाहिये। फसल चक्र का खरपतवार नियन्त्रण पर बहुत प्रभाव पड़ता है। जहां साइप्रस रोटंडस खरपतवार की समस्या है तिल की खेती उस क्षेत्र में करने से पाया गया है कि इस घास का बहुत हद तक नियंत्रण होता है इस प्रकार हेर-फेर कर खेत मैं फसल उगाने से घासपात अपने आप बहुत कम हो जाते हैं अत: कृषकों को उचित एवं आवश्यकतानुसार फसल चक्र अपनाने पर ध्यान देना चाहिये।

(८) धान के खेतों में बहुत-सा खरपतवार पानी की

शेष पृष्ठ ३८ पर

दलहनें सम्मिश्रित खेती में—उत्पादन क्षमता एवं आर्थिक विश्लेषण

इन्द्रपाल सिंह अहलावत एवं उत्तरसिंह
शस्य विभाग, भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली

मिश्रित फसलों का ज्ञान हमारे कृषकों को बहुत प्राचीन काल से है। फ़सलों को मिश्रित रूप में कई प्रकार से उगाया जा सकता है। जैसे फसलों के बीजों को आपस में मिलाकर खेत में छिड़क देना या इस मिश्रण को नियमित दूरी की कतारों में बोना इसके अतिरिक्त दोनों फसलों को अलग-अलग कतारों में बोना भी सम्मिलित है। **जिसे** हम सम्मिश्रित खेती की संज्ञा **देते हैं।** यहां पर हम इसी प्रकार की मिश्रित खेती का विशेष रूप से उल्लेख करेंगे। सम्मिश्रित खेती में, कुछ अपवादों को छोड़कर, उगाई गई भिन्न फसलों में प्रत्येक के उत्पादन में यद्यपि कोई बृद्धि नही होती है, परन्तु कुल उत्पादन अवश्य बढ़ जाता है।

अधिक उत्पादन क्षमता **वाली** दाने की फसलों की जातियों के विकास का देश के दलहन उत्पादन पर प्रतिकूल प्रभाव पड़ा है। उन क्षेत्रों में जहाँ परम्परागत दलहनी फसलों की खेती होती है, दाने वाली फसलों ने स्थान ले लिया है। कम अवधि में पकने वाली जातियों के विकास ने सम्मिश्रित खेती के और भी अधिक अवसर प्रदान किये हैं। दलहनी फसलों (विशेषकर खरीफ मौसम में उगाई जाने वाली) को सफलता पूर्वक दूर-दूर कतारों में उगाई जाने वाली में सम्मिश्रित फसल के रूप में उगाया जा सकता है। प्रायः गन्ना, कपास, मक्का तथा अरहर आदि को शुद्ध फसल के रूप में ही उगाया जाता है। इन फसलों में कतार से कतार की दूरी लगभग १½-२ फुट रक्खी जाती है। प्रारम्भिक अवस्था में इन फसलों की बृद्धि कम गति से होने के कारण कतारों के बीच के अन्तर में खरपतवार उग जाते है। ये खरपतवार फसल से पोषक तत्व एवं नमी आदि के लिए संघर्ष करते हैं और फसल की बृद्धि पर प्रतिकूल प्रभाव डालते हैं। इन कतारों के अन्तर में कम अवधि में तैयार होने वाली फसल का उगाना जहाँ एक ओर खरपतवारों की समस्या को दूर करता है वहां दूसरी ओर अधिक उत्पादन में भी सहायक होता है।

दलहनी फसलों को सम्मिश्रित फसल के रूप में उगाने का एक अतिरिक्त लाभ यह भी है कि इन फसलों की जड़ों में पायी जाने वाली गाठों के कीटाणु वातावरण से नत्रजन संचय करते हैं। यह नत्रजन मुख्य फसल के पोषण में सहायक होती है। वातावरण से नत्रजन संचय करने की शक्ति फसल-फसल पर निर्भर करती है। साधारणतया सम्मिश्रित फसल का पोषण मुख्य फसल को दिये गये पोषक तत्वों से ही प्राप्त हो जाता है। उन परिस्थितियों में जब दलहनी फसलों को अधिक फास्फोरस की आवश्यकता वाली फसलों में सम्मिश्रित फसल के रूप में उगाया जाता है, अतिरिक्त फास्फोरस की आवश्यकता हो सकती है। फसलों के बृद्धि व्यवहार को दृष्टि में रखते हुए निम्नलिखित फसलों के मिश्रण अधिक उत्पादन एवं आय के लिए प्रस्तावित किये जा सकते हैं।

दाने वाली फसलों में दलहनी फसलें :

प्राचीन समय से ही गेहूं या जौ के बीजों के साथ चने के बीजों को मिलाकर इस मिश्रण को छिड़ककर बोने की बिधि प्रचलित रही है। कुछ कारणों से, जिनमें गेहूं या जौ और चने के बीजों का समान वितरण न होना प्रमुख है, इस बिधि को अधिक प्रोत्साहन न मिल सका। बीजों के असमान वितरण से खेत में कुछ स्थानों पर पौधों की संख्या सघन तथा कुछ स्थानों पर बहुत ही कम हो जाती है।

अनुसंधानों के परिणामों से पता चलता है कि गेहूं या जौ और चना पक्षान्तर कतारों में उगाने से कुल उत्पादन तथा आय में प्रत्येक की शुद्ध फसल की तुलना में काफी बृद्धि हो जाती है। इस मिश्रण का शुष्क क्षेत्रों में, जहाँ भूमि में नमी की प्रमुख समस्या होती है. विशेष महत्व है। चने की फसल को कम पानी की आवश्यकता और इसकी जड़ों द्वारा भूमि की गहरी सतहों से नमी प्राप्त करना इसको एक आदर्श मिश्रण बनाता है।

कुछ भागों में मक्का और ज्वार के खेतों मे मूँग या उर्द के बीजों को छिटक कर बोने की प्रथा है। इसके अतिरिक्त ज्वार और अरहर का मिश्रण भी कुछ भागों में प्रचलित है। ये फसलें साथ-साथ ही उगाई जाती है। पहले मिश्रण में उर्द या मूँग को पकने पर काट लिया जाता है। दूसरे मिश्रण में ज्वार की बुवाई के दो-तीन माह उपरान्त हरे चारे के रूप में काट लिया जाता है। और अरहर अकेली ही खेत में रह जाती है। दाने के लिए उगाई गई ज्बार अरहर के पौधों की बृद्धि पर प्रतिकूल प्रभाव डालती है। बाजरे की फसल भी इसी प्रकार का प्रभाव डालती है। मक्का, ज्वार या बाजरा में उर्द या मूँग उगाने पर ४-५ क्विन्टल प्रति हैक्टर अतिरिक्त दलहन उत्पादन प्राप्त किया जा सकता है। मक्का की बौनी और सीधी बढ़ने वाली जातियों जैसे किसान सिंथेटिक एरेक्ट में अरहर को भी उगाया जा सकता है।

तिलहनी फसलों में दलहनी फसलें :

खरीफ मौसम में अरण्डी को सामान्यतः कतारों में २ फुट

की दूरी पर बोया जाता है। प्रारम्भिक अवस्था मे मन्द वृद्धि होने के कारण मूग या उर्द की एक कतार दो अरण्डी की कतारों के बीच में सफलतापूर्वक उगाई जा सकती है। इसके अतिरिक्त तिल और मूँग को पक्षान्तर कतारों में सफलतापूर्वक अधिक उत्पादन और आय के लिए उगाया जा सकता है।

रबी मौसम में अलसी मे चना तथा मसूर को उगाया जा सकता है। तिलहनी तथा दलहन को पक्षान्तर कतारों में बोया जाता है। यह मिश्रण सिचित और असिचित दोनों क्षेत्रों में अधिक उत्पादन देता है।

रेशे वाली फसलों में दलहनी फसलें :

कपास को साधारणतया मई-जून के महीने मे २-२½ फुट की दूरी पर कतारों में बोया जाता है। प्रारम्भिक ६०-७५ दिनों तक फसल की वृद्धि बहुत ही कम गति से होती है। पौधे मुख्य रूप से ऊंचाई में ही बढ़ते हैं और शाखायें बहुत ही कम निकलती है। जिसके परिणामस्वरूप दो कतारों के अन्तर वाले स्थान में खरपतबार उगने लगते है। इन स्थानों पर मूँग, उर्द या लोबिया की एक कतार सफलतापूर्वक उगाई जा सकती है। दलहनी फसल की अधिकांश आवश्यकतायें कपास को दिये गये पोषक तत्वों तथा पानी से ही मिल जाती है। लेकिन इसको एक या दो अतिरिक्त कीटाणुनाशक दवाओं के छिड़काव की आवश्यकता होती है। यह फ़सल पर कीड़ों के प्रकोप पर निर्भर करता है। कपास पर कीटाणुनाशक दवायें प्राय: बुवाई के दो महीने बाद से ही छिड़कनी शुरू की जाती है। मिश्रित फसल ६५-८५ दिनों में पककर तैयार हो जाती है। और इस प्रकार कपास की फसल पर बिना किसी प्रतिकूल प्रभाव डाले ५-६ क्विंटल प्रति हैक्टर दलहन की उपज प्राप्त हो जाती है।

गन्ने में दलहनी फसलें :

उत्तरी भारतवर्ष में गन्ने की मुख्य फसल को फरवरी मार्च के महीनों में बोया जाता है। इस समय तापक्रम कम होने के कारण इसका अंकुरण तथा प्रारम्भिक बृद्धि बहुत ही मंद गति से होती है। जिससे लगभग दो-तीन महीने (अप्रैल-मई) तक कतारों के बीच का अन्तर खाली पड़ा रहता है। अप्रैल-मई के महीनों में तापक्रम में बृद्धि होने पर गन्ने की बृद्धि तेजी से शुरू हो जाती है। कम अवधि में पकने वाली दलहने जैसे मूँग को इस ग्रीष्म काल में दो कतारों के अन्तर में अतिरिक्त उत्पादन के लिए उगाया जा सकता है। मूँग की फसल के लिए अतिरिक्त खाद की कोई आवश्यकता नहीं होती है। भारतीय कृषि अनुसंधान संस्थान पर गन्ने में मूँग को उगाने पर ५.५ क्विंटल प्रति हैक्टर मूंग की पैदावार प्राप्त की गई।

अक्टूबर में बोई जाने वाली गन्ने की फसल में रबी की दलहने जैसे चना, मसूर या मटर को सफलतापूर्वक उगाया जा सकता है। सर्दी के महीने में कम तापक्रम के कारण गन्ने की बृद्धि बहुत ही कम होती है और इस प्रकार ये साथ-साथ उगने वाली फसले संघर्ष रहित ही रहती है। गन्ने को दिये गये पोषक तत्व तथा पानी इन दलहनों की भी आवश्यकता पूरी करते हैं। फास्फोरस की कमी वाली भूमियों में २०-२३ किलो प्रति हैक्टर अतिरिक्त फास्फोरस देना लाभप्रद होता है। क्योंकि इन दोनों फसलों को फास्फोरस की अधिक आवश्यकता होती है।

दलहनों मे दलहनी फसलें :

मध्यम अवधि की अरहर की किस्में प्राय: १½ से २½ फुट की दूरी पर कतारों में बोई जाती है। आरम्भिक दो तीन महीने तक इसकी वृद्धि मुख्य रूप से लम्ब रूप में होती है। शाखाओं का फैलाव बहुत थोड़ा होता है। अरहर की कतारों के मध्य में मूंग, उर्द या लोबिया की एक कतार बोना अरहर की फसल पर बिना प्रतिकूल प्रभाव डाले ५-६ क्विंटल प्रति हैक्टर अतिरिक्त दलहन उत्पादन प्रदान कर सकता हैं। उपर्युक्त फसलें दो-तीन महीने मे पककर तैयार हो जाती हैं।

फलों वाली फसलों में दलहनी फसलें :

केले की फसल जून-जुलाई के महीने में लगाई जाती है। कतारों से कतारों का अन्तर ७½ फुट तथा पौधों से पौधों का अन्तर ६ फुट से ७½ फुट रखा जाता है। केले के प्रारम्भिक वृद्धि धीरे होने से कतारों तथा पौधों के अन्तर का स्थान काफी समय तक खाली पड़ा रहता है। केले की फसल लगाते समय ही दो कतारों के बीच के अन्तर में मूँग की ८-१० कतारें बोई जा सकती है। मूँग ६०-६५ दिनों में पककर तैयार हो जाती है। मूँग काटने के बाद इस खाली स्थान को हल्दी या अदरक लगाने के लिए भी प्रयोग किया जा सकता है। ये दोनों फसलें प्राय: आठ महीने में तैयार हो जाती है। इस मिश्रित खेती में केले को समुचित खाद देना अति आवश्यक है ताकि मिश्रित फसलों में आपस में प्रतिद्वन्दता न हो सके।

उत्पादन क्षमता तथा आर्थिक विश्लेषण—एक दृष्टि मे

उपर्युक्त विवरण से यह स्पष्ट हो जाता है कि खरीफ मौसम में बहुत सी फसलों (मक्का, ज्वार, अरहर, अरण्डी, कपास, तिल तथा केला) में उर्द, मूँग या लोबिया को सफलता पूर्वक उगाया जा सकता है और ४-६ क्विंटल प्रति हैक्टर अतिरिक्त दलहन उत्पादन मुख्य फसल की आर्थिक उपज पर बिना प्रभाव डाले प्राप्त किया जा सकता है। इस तरह ६००-८०० प्रति हैक्टर अतिरिक्त शुद्ध आय प्राप्त हो सकती है। फरवरी-मार्च में बोये गन्ने में मूंग उगाने पर भी लगभग इतनी ही अतिरिक्त आय अर्जित की जा सकती है।

सिचित और असिचित दोनों ही क्षेत्रों में दाने वाली फसल तथा दलहनी फसल को पक्षान्तर कतारों में उगाने से ५००-१००० तक की अतिरिक्त आय प्राप्त हो सकती है।

पतझड़ के मौसम में बोई गयी गन्ने की फसल में रबी ऋतु की दलहने (चना, मसूर व मटर) उगाना काफी लाभप्रद होता

शेष पृष्ठ ४० पर

मूंगफली की नई उन्नत किसमें उगाइए

गणेशचन्द्र श्रीवास्तव
तिलहन अनुसंधान केन्द्र, कृषि महाविद्यालय,
रायपुर (म० प्र०)

खाद्य सामग्रियों में मूंगफली का विशेष महत्व है। मूंगफली एक व्यापारिक फसल है। इसके बहुमुखी इस्तेमाल से इसकी उपयोगिता दिन प्रतिदिन बढ़ती जा रही है। तेल की मात्रा मूगफली में लगभग ४४ से ५० प्रतिशत तक पाई जाती है। मूंगफली के तेल का मुख्य इस्तेमाल भोजन बनाने, वनस्पति घी तैयार करने, साबुन निर्माण आदि में होता है। भुने हुए अथवा कच्चे मूंगफली के दाने स्वादिष्ट एवं पौष्टिक होते हैं। इसमें प्रोटीन तथा ए, बी, और बी २ श्रेणियों के विटामिन भी पाये जाते हैं। तेल निकालने के बाद बचा भाग खली के रूप में पशुआहार एवं खाद की तरह इस्तेमाल होता है। खली में ७ से ८ प्रतिशत नत्रजन १.५ प्रतिशत फास्फोरस तथा १.२ प्रतिशत पोटाश भी पाये जाते हैं। फसल पकने पर भी हरी होती है इसके डंठल एवं पत्तियों को सुखाकर सग्ईलेज तैयार करते हैं जिसे जानवर रुचि पूर्वक खाते हैं। मूंगफली के पौधों के चूरे में १४ प्रतिशत प्रोटीन और १.७ प्रतिशत कैल्शियम होता है।

मूंगफली का जन्म स्थान ब्राजील समझा जाता है। १६वीं शताब्दि के लगभग इसका परिवेषण विश्व के अन्य देषों में हुआ। विश्व के मूंगफली उगाने वाले देशों में भारत, चीन, फ्रांस, पश्चिमी अफ्रीका, नाईजीरिया, उत्तरी अमेरिका आदि मुख्य हैं।

मूंगफली की खेती का क्षेत्रफल भारतवर्ष में लगभग १५.४ मिलियन एकड़ है। अन्य देशों की अपेक्षा अपना देश मूंगफली की पैदावार में अग्रणी है। संसार में कुल २ करोड़ एकड़ भूमि में मूंगफली की खेती की जाती है। जिससे प्रतिवर्ष लगभग ५० लाख टन मूंगफली पैदा होती है। भारत में आजकल लगभग १.३८ करोड़ एकड़ भूमि में इसकी खेती की जाती है। जिससे १४.३ लाख टन उपज प्राप्त होती है। हमारे देश में औसत उपज की कमी के कई कारण हैं जिनमें मुख्य बीमारियों से फसल की रोकथाम न होना, कमजोर अंकुरण वाले बीजों की बोवाई करना और खाद आदि का उचित प्रयोग न होना। उन्नत तरीकों से खेती करके उपज बढ़ायी जा सकती है। सरकार भी इसके लिए प्रयत्नशील है।

जलवायु और मिट्टी

शीतोष्ण और समशीतोष्ण कटिबंधों के ४५° उत्तर तथा २०° दक्षिण अक्षांश में आने वाले देशों में मूंगफली की खेती की जाती है। २० से ५० इंच वार्षिक वर्षा फसल के लिए होती है परन्तु पाला, सूखा, पानी का जमाव हा है। रेतीली दोमट तथा अच्छे निकास वाली काली मिट्टी फसल के लिये अच्छी होती है। मूंगफली असिंचित एवं सिंचित दोनों क्षेत्रों में उगाई जाती है। असिंचित क्षेत्र में इसकी खेती खरीफ में करते हैं तथा सिंचित क्षेत्र में रबी का मौसम उपयुक्त होता है।

जमीन की तैयारी

बोवाई के पहले खेत को दो बार जुताई तथा पाटा चलाकर मिट्टी बारीक और भुरभुरी कर लेते हैं।

खाद और उर्वरकों का इस्तेमाल

१० से १२ टन प्रति हैक्टर गोबर की खाद बोने से पहले खेत में डालकर अच्छी तरह मिला देते हैं। असिंचित क्षेत्रों के लिए खरीफ मौसम में ३० किलो नत्रजन, ६० किलो फासफोरस तथा २० किलो पोटाश प्रति हैक्टर की दर और सिंचित क्षेत्रों के लिए रबी मौसम में ४० किलो नत्रजन, ८० किलो सुफर फास्फेट तथा ४० किलो पोटाश प्रति हैक्टर की दर से बोने के समय देना चाहिए। उर्वरकों को या तो खेत में छिड़ककर अच्छी प्रकार मिट्टी में मिला देते हैं अथवा बीज से ८ सेन्टीमीटर नीचे डालते हैं।

बोआई का समय

खरीफ मौसम में जून व जुलाई तथा कहीं-कहीं पर अगस्त तथा सितम्बर तक और रबी में जनवरी से मार्च तक का समय बोवाई के लिए उपयुक्त होता है। बोवाई के पहले खेत में फसल को जमीन में लगने वाले कीड़ों से बचाने के लिए १० प्रतिशत बी० एच० सी०, का ४० किलो प्रति हैक्टर की दर से छिड़काव करते हैं।

बोवाई का तरीका

बोने के पहले अच्छे स्वस्थ बीजों का चुनाव करते हैं। इन बीजों को एग्रोसीन जी० एर० (४ औंस प्रति ५० किलो बीज) अथवा बीज और फ्लिट ८३ प्रतिशत का क्रमशः ३:१ के अनुपात में मिलाते हैं। इससे बीजों की जमीन में पाये जाने वाले कीड़ों तथा बीज उत्पन्न रोगों से रोकथाम होती है और अंकुरण अच्छा होता है। बीज की मात्रा ६० से ८० किलो प्रति हैक्टर रखते हैं। असिंचित क्षेत्रों में कतारों की दूरी ३० सेंटीमीटर और पौधों की दूरी १५ सेंटीमीटर रखते हैं। सिंचित क्षेत्रों के लिए यह दूरी १५ से ४० सेंटीमीटर उपयुक्त होती है। कतारों और पौधों की दूरी मूंगफली की किस्मों के अनुसार घटाई और बढ़ाई जा सकती है। जैसे कुछ किस्में फैलने वाले (स्प्रेडिंग) होती है इनके लिये ९ इंच पौधों की तथा डेढ़ फीट कतारों की दूरी रखते हैं। गुच्छेदार (बंच) किस्मों के लिए ६ इंच पौधों की तथा १ फीट कतारों की दूरी रखते हैं। उपरोक्त कतारों की सुविधानुसार

२-३ इंच गहरा कुदाली द्वारा सीधी कूंड (नाली) निकालते हैं और बीज को तथाकथित दूरियों पर गिराते हैं। नारियों में बीज को २ या ३ इंच से गहरा नही रखते। बोवाई के बाद एक हल्का पाटा चला देते हैं ताकि बीज मिट्टी से ढंक जाय।

फसल चक्र एवं फसल मिश्रण

मूंगफली एक दलहन वाली उत्तम फसल है। जो अब फसल चक्र में शामिल की जाती है तो काफी लाभ होता है। मध्य एवं प्रायद्वीप भारत में असिंचित क्षेत्रों में ज्वार मूंगफली और कपास का फसल चक्र काफी उत्तम माना जाता है। मूंगफली के बाद कपास रागी और दूसरी धान्य वाली फसलों को लेने से लगभग २५ से ४० प्रतिशत तक की वृद्धि पाई जाती है। इसको खालिस भी उगाते हैं। और कभी-कभी कसास अंडी आदि के बीच में अन्तरवर्ती फसल के रूप में उगाया जाता है।

निराई और गुड़ाई

खुरपी अथवा कुदाली द्वारा फसल बोने के ३०वें दिन और ४५वें दिन अथवा खेत में घास की मात्रा के अनुसार उपरोक्त समय के पहले अथवा बाद में दो या तीन बार आवश्यकतानुसार गुड़ाई करके घास को निकाल देना चाहिये। पौधों मे फूल आने की बाढ़ दो बार होती है। पहले फूल की बाढ़ के समय कतारों के बीच की मिट्टी को पौधों के पास चढ़ा देते है। इस प्रकार मिट्टी चड़ाने से कतारों के बीच की दूरी नाली में परिवर्तित हो जाती है तथा पौधों के स्थान पर मेड़ बन जाते हैं। नालियां अधिक वर्षा जल अथवा सिंचाई जल के निकास का कार्य करती हैं। साथ ही फूल में गर्भाधान की क्रिया की समाप्ति पर कल्ले निकलते हैं। जिन्हें ढंकने के लिए आवश्यक मात्रा में मिट्टी प्रदान करती है। फूल से निकले कल्ले या पीके ही बाद में मूँगफली का रूप धारण करती हैं और इनको मिट्टी से ढंकना आवश्यक होता है। फूल की दूसरी बाढ़ बोने के ५० से ६० दिन के बाद या किस्मों के अनुसार उपरौक्त दिनों के पहले या देर से होती है। इस समय दूसरी बार नालियों से मिट्टी को पौधों की मेड़ पर चढ़ा देते हैं। मूँगफली की किस्म कोई भी हो गुड़ाई करके दो बार मिट्टी चढ़ाना आवश्यक होता है। मूँगफली में मिट्टी चढ़ाने से उपज में लगभग २० प्रतिशत की वृद्धि होती है ऊपरी पीके को जमीन तक पहुंचाने में समय लगता है और इससे मूँगफली ठीक नहीं बैठ पाती।

शेष पृष्ठ ३४ से

नालियों द्वारा भी पहुंच जाता हैं अतः सिंचाई करते समय इस प्रकार के खरपतवारों को पहले से निकालकर बाहर फेंक देना चाहिये तथा नहर अथवा तालाब द्वारा सिंचाई करने समय हौज से पानी नाली की ओर बहने पर खेत के पास इन खरपतवारों को रोकने के लिए जाली इत्यादि का प्रबंध कर देना चाहिये ताकि अन्य श्रोतों द्वारा पानी के साथ खरपतवार को खेत में पहुंचने से रोका जा सके।

(९) खेत में बिना सड़ी गोबर अथवा कम्पोस्ट की खाद डालने से हम पाते है कि खरपतवार के बीज खेत में पहुंचकर अपनी वृद्धि करते हैं और फसल के साथ बढ़कर उपज में हानि पहुंचाते हैं : दूसरी हानि यह भी होती है कि बिना अच्छी प्रकार सड़ी खाद खेत में डालने से उसकी पूरी उपयोगिता खेत में नहीं प्राप्त हो पाती अतः खेत में खाद की उपलब्धि बढ़ाने और उसे अधिक उपयोगी बनाने के लिये यह आवश्यक होता है कि खूब अच्छी प्रकार सड़ी खाद खेत में डालें ताकि गोबर अथवा कम्पोस्ट खाद द्वारा खेत में खरपतवारों के उत्पन्न होने की शंका न रहे। इस संस्थान पर पशुशाला के मूल और उसके धोवन का प्रयोग करने से यह पाया गया है कि धान के खेत में खरपतवार कम आते हैं वैसे अभी इस तथ्य की जानकारी की जा रही है किन्तु यह सत्य है कि उपज वृद्धि पर इसका बहुत ही अच्छा परिणाम मिलता है। हमारे किसान भाई पशुशाला की मूत्र और धोवन पर ध्यान न देकर उसे नुकसान होने से नहीं बचाते जो नीची जमीन की ओर बहकर व्यर्थ ही नष्ट हो जाता है और गंदगी पैदा करता है। अतः पशुशाला के मूत्र और धोवन द्वारा उपज वृद्धि एवं कुछ हद तक खरपतवारों को खेत में नियंत्रण के लिए प्रयोग करना चाहिये। खरपतवार की उपस्थिति में उर्वरक की टाप ड्रेसिंग खेत में नहीं करनी चाहिये।

(१०) वर्षा की फसल काटने के बाद खेत की जुताई कर देनी चाहिये ताकि बहुवर्षीय खरपतवार खेत में अपना अड्डा न जमा सकें और ऊपर आकर सूख जांय अथवा जमीन में सड़ जाय। जुताई करते समय बीज बन गए खरपतवार के पौधों को चुनकर पहले अलग करके फिर बाकी खरपतवारों की जुताई करनी चाहिये। हम देखते हैं कि खरपतवारों के विनाश के साथ-साथ खेत से हानिकर कीड़ों का भी विनाश हो जाता है एवं अन्य कई रूप मैं भूमि को लाभ पहुंजाता है। मेड़ों पर स्थित खरपतवारों को बिल्कुल साफ कर देना चाहिये और सदैव मेड़ों को खरपतवार रहित रखना चाहिये। ट्रैक्टर इत्यादि से जुताई करते समय फालो में लगे खरपतवार को निकाल देना चाहिये अन्यथा एक खेत से खरपतवार दूसरे खेत में फालों के साथ फंस कर चले जाते हैं और खरपतवार की वृद्धि खेतों में होती है। अतः इस प्रकार खरपतवारों को रोकने का सदैव ध्यान देना चाहिये।

जिस के चित्त में तरंग उठते ही रहते हैं वह सत्य का दर्शन कैसे कर सकता है। चित्त में तरंग का उठना समुद्र के तूफान जैसा है। तूफान में जो सुकानी सुकान पर काबू रख सकता है वह सलामत रहता है। ऐसे ही, चित्त की अशांति में जो रामनाम का आश्रय लेता है वह जीत जाता है।

—महात्मा गांधी

(शेष पृष्ठ ३२ से)

	७-कोयम्बटूर एवं सालेम (तामिल नाडु)	ई. सी. ६८४१५
	८-तलंगाना (आन्ध्र प्रदेश)	ई. सी. ६९८७४
	९-हरियाणा, पंजाब, जम्मू-कश्मीर एवं उड़ीसा।	सनराइज सेलेक्शन
४. बसन्त ऋतु	१०-मध्य एवं पश्चिम उत्तर प्रदेश में गंगा का मैदानी क्षेत्र	ई. सी. ६९८७४ सनराइज सेलेक्शन

पौधों की छटाई तथा रोपाई :

जमाव के १०-१२ दिन के बाद अनावश्यक पौधों की छँटाई कर देनी चाहिए जिससे पंक्तियों में पौधों से पौधों की दूरी २०-२५ से० मी० रह जाये।

खरपतवार की रोकथाम :

बोआई के लगभग २५-३० दिन बाद करनी चाहिए। पौधे जब छोटे हों तभी निराई करना आवश्यक होता है। इससे पौधों की बढ़वार अच्छी रहती है।

सिंचाई :

यद्यपि असिंचित इलाकों में भी सूरजमुखी से अच्छी पैदावार मिल जाती है फिर भी सिंचित दशाओं में उगाई गई फसल से उपज अधिक मिलती है। रबी के मौसम में ३-४ सिंचाइयों और जायद में ४-५ सिंचाइयों की आवश्यकता होती है। पहली सिंचाई बोआई के ३० दिन बाद तथा शेष सिंचाई आवश्यकतानुसार इस तरह करनी चाहिए कि फूल निकलते समय तथा दाना बनते समय खेत में पर्याप्त नमी रहे। इस बात का ध्यान रखना चाहिए कि तेज हवा चलते समय सिंचाई नहीं की जाये अन्यथा पौधों के गिरने का डर रहता है। खरीफ में भी यदि काफी समय तक वर्षा न हो तो आवश्यकतानुसार सिंचाई कर देनी चाहिए।

मिट्टी चढ़ाना :

सूरजमुखी के फूल भारी होते हैं अतः पौधों के गिरने का भय रहता है। अतः बोआई के ४०-४५ दिन बाद फूल निकलने से पहले पौधों पर मिट्टी चढ़ा देना चाहिए, जिससे उनके गिरने का डर नहीं रहेगा।

कीड़ों से रोकथाम :

बीज अवस्था में कर्तन क्रमियों के आक्रमण से रक्षा के लिए २५ किग्रा० प्रति हैक्टर की दर से हैप्टाक्लोर (५ प्रतिशत) बोआई के समय देना चाहिये। शिरा वेधकों तथा जैसिड के लिये पालोथियोन-१०० या अम्बीथियोन या इकैलक्स क्रमशः २५० मिली०, ५०० मिली० तथा १ लिटर प्रति हैक्टर की दर से छिड़काव करना चाहिये।

मधुमक्खी द्वारा फूलों का सेचन :

सूरजमुखी में एक समस्या जो हर जगह देखने को मिलती है वह फूलों के मध्य में दाना न पड़ना है। इसका एक कारण यह भी है कि मधुमक्खियां या अन्य कीड़े सूरजमुखी के फूलों का सेचन पूर्ण रूप से नहीं कर पाते। सूरजमुखी एक परसंचित फसल है अतः कीड़े मकोड़ों जैसे मधुमक्खी भ्रमर इत्यादि की पर्याप्त संख्या होनी चाहिये। किसानों के खेतों पर लगाये गये सूरजमुखी की फसल में यह देखा गया है कि गर्मी के मौसम मे इनकी संख्या कम होती है। इसके विपरीत जाड़ों वाली फसल में इनकी पर्याप्त संख्या पाई जाती हैं। जिससे परसेचन कार्य पूरा होता है। अतः सूरजमुखी की खेती में निम्न बातों की सावधानी रखनी चाहिए—

१. बोआई का समय इस तरह निर्धारित किया जाये जिससे फूल खिलने की अवस्था में ताप क्रम अधिक न हो।

२. मधुमक्खियों और भौंरों की रक्षा के लिए यह अत्यंत आवश्यक है कि केवल चुने हुये रसायनों जैसे इकैलक्स या पोलीथियोन-१०० या एम्बीथियोन का ही प्रयोग करें। फूल निकलते समय किसी भी कीटनाशक या रोगनाशक दवा का प्रयोग न करें। मेटासिस्टाक्स या एन्ड्रोन का प्रयोग करने पर परागण में सहायता करने वाले कीट मर जाते है।

रोगों से रोक थाम

सूरजमुखी पर उकठा, सड़न और झुलसा रोग का प्रकोप होता है। उन्नत किस्मों और दवा से उपचारित बीज ही प्रयोग में लाना चाहिये। इसके साथ एक ही खेत में लगातार सूरजमुखी न उगाकर उसे फसल चक्रों में लेना चाहिए। खेत में जल निकास का समुचित प्रबन्ध होना चाहिये। रोगी पौधों को समय-समय पर निकाल कर जला देना चाहिए।

पक्षियों से बचाव :

सूरजमुखी के पकते हुए खेतों में पक्षी बहुत नुकसान पहुंचा सकते हैं। ऐसी स्थिति में पक्षियों से बचाव के उपाय करना अत्यन्त आवश्यक है वरना उपज में भारी कमी आ जाती है।

कटाई और मड़ाई :

जब फूलों के बीच का भाग पीला पड़ जाये तो कटाई आरम्भ कर देनी चाहिये। पकने का समय बोआई की तिथि, स्थान आदि पर निर्भर करता है। फूलों को काटने के बाद धूप में अच्छी तरह सुखा लेना चाहिए और उसके बाद डंडों से पीट कर दाने अलग किये जा सकते हैं। इसके बाद बीजों को धूप में इतना सुखाना चाहिए कि उनमें नमी १० प्रतिशत से अधिक न रहे।

उपज :

सूरजमुखी की उपज मौसम, किस्म और स्थान पर निर्भर करती है। वैज्ञानिक विधियों से खेती करने पर सिंचित इलाकों में औसतन २० क्विंटल प्रति हैक्टर रबी और जायद में और खरीफ में १०-१२ क्विंटल प्रति हैक्टर की उपज आसानी से मिल सकती है। असिंचित इलाकों में सामान्य रूप से वर्षा होने पर ६-१० क्विंटल प्रति हैक्टर तक उपज मिल सकती है।

(शेष पृष्ठ ३६ से)

है। समुचित प्रबन्ध होने पर ऐसे खेतों से लगभग १२००-१५०० रु० तक की अतिरिक्त आय प्राप्त हो सकती है।

केले की फसल में मूंग और इसके बाद अदरक या हल्दी की सम्मिश्रित खेती करने से लगभग ६०००-७००० रु० तक का अतिरिक्त शुद्ध लाभ प्राप्त किया जा सकता है।

सम्मिश्रित खेती के उत्पादन तथा आर्थिक पहलुओं के विश्लेषण से यह प्रत्यक्ष है कि सम्मिश्रित खेती वास्तव में एक लाभप्रद प्रस्ताव है और इसे सफलता पूर्वक सिंचित व असिंचित क्षेत्रों में अपनाया जा सकता है।

जिन दलहनी फसलों का सम्मिश्रित खेती में वर्णन किया गया है उनकी उन्नत जातियाँ नीचे दी जा रही हैं।

फसलें	जातियाँ
मूंग	पूसा वैशाखी, टाइप ४४, पी. एस. १६, एस ८
उर्द	टाइप ९, एस १
लोबिया	पूसा फाल्गुनी, पूसा दो फसली, एफ. एस. ६८
चना	
सिंचित	सी. २३५, टाइप ३, एच ३५५
असिंचित	जी २४, जी १३०
मसूर	एल ९-१२, टाइप ३६, पूसा ४, बोम्बे १८
मटर	टाइप १६३, ई. सी. ३३८६६
अरहर	पूसा अगेती, शारदा, मुक्ता, टाइप २१

विद्या ही मनुष्य की बड़ी सुन्दरता है, वही उसका छिपा हुआ धन है, भोग, यश तथा सुख देने वाली है, गुरुओं की भी गुरू है। विद्या ही परदेश में बन्धु है, परम देवी है, और (वही) राजाओं के बीच पूज्यनीय है (अतएव) विद्या-विहीन मनुष्य पशु ही है ॥ २० ॥

—भर्तृहरि

यह अद्भुत रीति है कि धन की गरमी के बिना वही मनुष्य जिसकी सब इन्द्रियाँ वही हैं, वही व्यवहार (भी) है, वही प्रखर बुद्धि और वही वाणी है, क्षणमात्र में और ही हो जाता है ॥४०॥

—भर्तृहरि

जब मुझे अपना हृदय कठोर एवं नीरस जान पड़े, जब जीवन का समस्त माधुर्य नष्ट हो जाय, तब हे शान्ति देव ! तुम गीत सुधा की करुणा धारा बनकर बरस जाना।

जब कर्म प्रबल हो मुझे चारों ओर से घेर ले तब तुम शान्त चरणों से धीरे-धीरे आ जाना।

जब मेरा दीन हीन हृदय कंजूस के समान मुझे एक कोने में बन्द कर ले तब मेरे द्वार खोल तुम यहाँ नित्य समारोह किया करना।

जब वासना हृदय में छाकर मुझे धोखा दे और अपनी धूल से मुझे अन्धा कर दे तब तुम हे पवित्र ! हे चिर जागृत !! अपने प्रखर तेज से प्रभावित हो उठना।

—रवीन्द्रनाथ टैगौर

गुनाह छिपा नहीं रहता। वह मनुष्य के मुख पर लिखा रहता है। उस शास्त्र को हम पूरे तौर से नहीं जानते, लेकिन बात साफ है।

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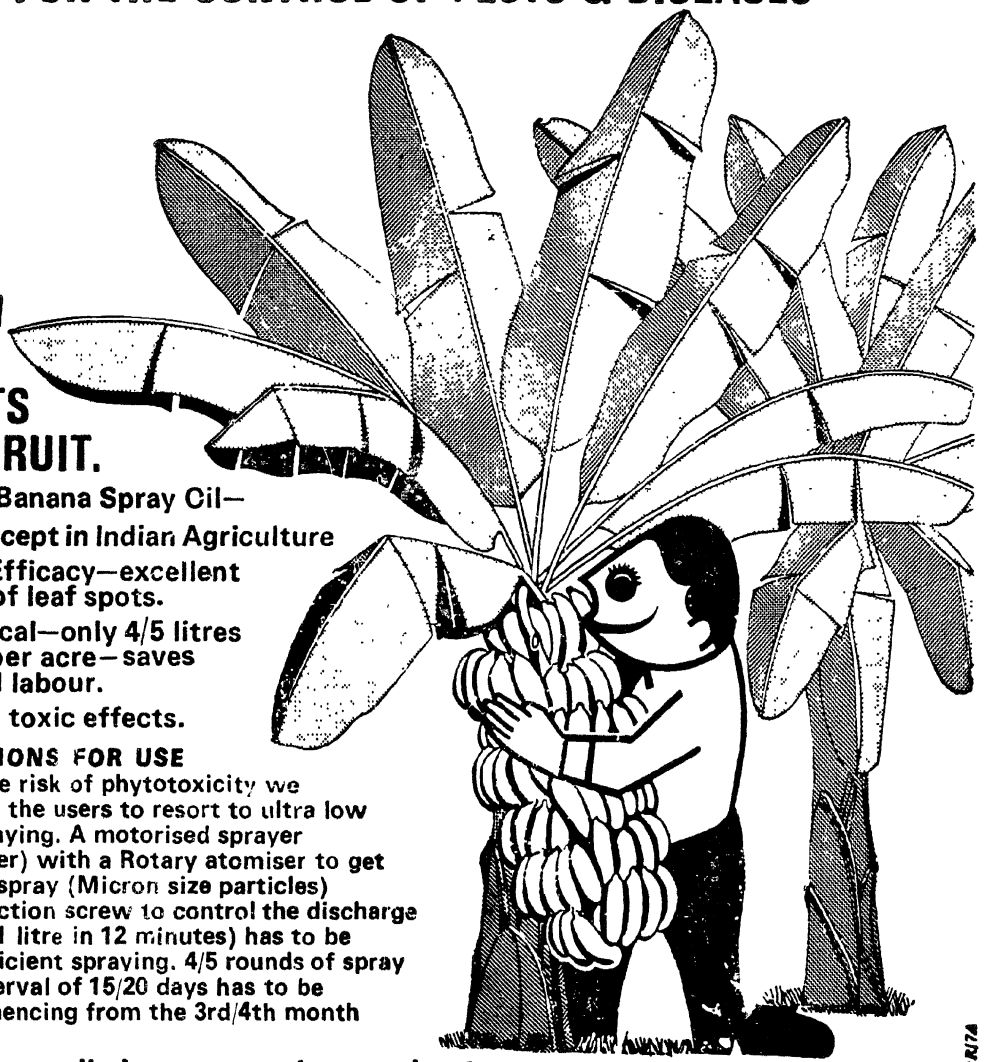

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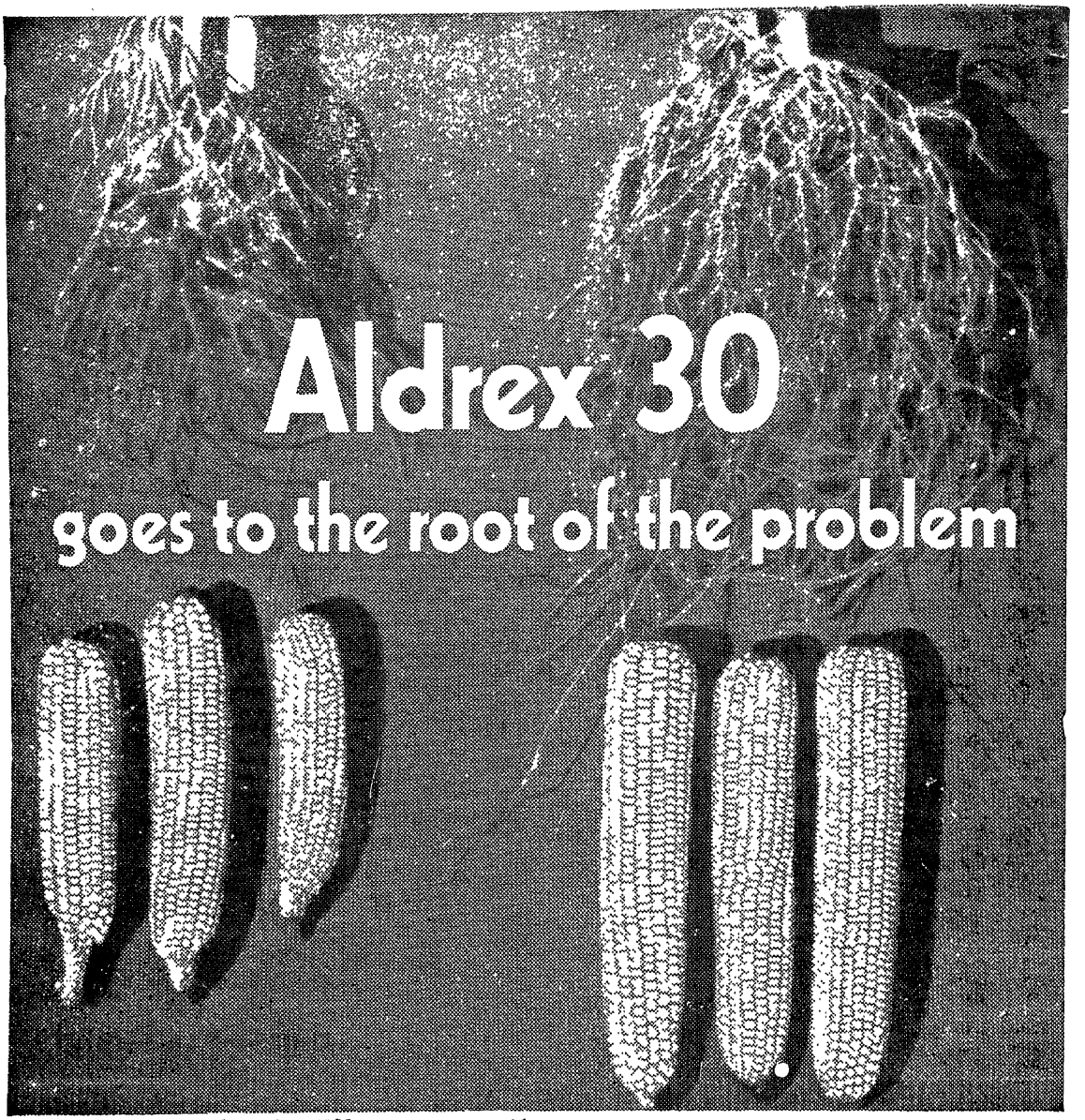

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अथर्व वेद, काण्ड ३, सूक्त ३०, मंत्र ३

O people ! Thou art all brothers and sisters. A brother should not be jealous of a brother and a sister should not be jealous of a sister. All should march forward in union with each other and with one determination and should speak in a pleasant manner.

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FARMER AND PARLIAMENT

VOL. XI NO. 3 MARCH 1976

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OUR COVER

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Editor's Page

A note from the Chairman of the National Seeds corporation is being published in this issue of the magazine. The chairman has rightly indicated the importance of improved seeds and seeds of high yielding varieties of crops for increasing agricultural production in the country. It is no doubt correct that it is the seeds of high yielding varieties particularly of wheat that has helped in revolutionising the agricultural production in India. The other essential inputs however, are also of considerable importance. Without adequate supply of water, for instance, plant cannot grow and all other inputs become useless. Similarly, without requisite supply of nutrients, full potential of improved seeds and seeds of high yielding varieties cannot be exploited. The reason why the crops of high ylelding varieties give high yields is that these crops are capable of assimilating large quantities of fertilisers without the risk of longing, and thereby the yields are high. Thus fertilisers also play an important role in increasing production.

The consumption of fertilisers per unit area in India is still low. In rain-fed areas, where the rains are scanty, one could not expect large consumption of fertilisers. Even in the irrigated areas and areas of adequate rainfall, the consumption is comparatively low. During the last decade or so there has been four to five-fold increase in the consumption of fertilisers in the country, but even so the consumption is still low. Till 1972-73 the consumption of fertilisers was increasing at a fairly rapid pace. In 1973, however, owing to heavy increase in the prices of fertilisers and inadequate supply the consumption declined. In 1974-75 and 1975-76 the consumption has improved to some extent, but the rate of growth is not as adequate as it should be. The reason is not far to seek. The price of urea, for instance, enhanced from Rs. 1050 to Rs. 2000 per tonne from 1st June, 1974. This sudden and heavy increase in the price of urea naturally benumbed the enthusiasum of the farmers to use fertilisers In July, 1975 the price was reduced to Rs. 1850 per tonne and from 16th March, 1975 there has been a further reduction of Rs. 100 per tonne. But even now the farmers' price of urea is almost double of what used to be the price in 1971-72.

While it is true that during the last one year a reduction of Rs. 250 per tonne in the price of urea has been made by the Government, and the consumption of urea has also looked up to some extent, the present price of urea is still very high It has reduced considerably the margin of profit of the cultivator, particularly when there is a tendency, perhaps rightly, to keep low the output prices of the cultivator. The Government procurement price of wheat, for instance, continue to be Rs. 105 for the last two years. In order, therefore, to provide a reasonable margin of profit to the cultivator when the prices of other articles are ruling high, it is necessary that the price of urea should be further reducee by lastad about Rs. 250 to Rs. 300 per tonne.

At present Government is levying an excise duty of 15 per cent on urea. In the interest of maintaining and increasing agricultural production it seems necessary that this excise duty on fertilisers should be withdrawn.

The ex-factory price of urea produced in India contains a substantial element of contribution to the fertiliser pool. It is understood that about Rs. 360 per tonnne out of the price payable by the farmer, go to the fertiliser pool. Previously the price of urea in the international markets was very high and for that reason it was necessary for the internal manufacturers of urea to make a contribution to the fertiliser pool so that the imported urea could also be sold at reasonable prices. Now the prices of fertilisers in international markets have crashed. It is understood that the latest purchase of urea has been made at the price of $112 per tonne, F.A.S. Indian reports. This means that the landed price of imported urea in India is now of the order of Rs. 1000 per tonne as against the price of Rs. 1750 charged from the farmers. There, therefore, appears to be no reason now to make such a heavy contribution by the urea producing factories in India to the fertiliser pool and it should be possible to reduce the over all price of urea substantially by

(a) abolishing the excise duty on urea; and

(b) eleminating or substantially reducing the contribution which the factories producing urea have to make to the fertiliser pool.

We strongly urge upon the Government that the question of further reducing substantially the price of urea should be considered.

FARMER AND PARLIAMENT

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I.S.N. Bhalla, hereby declare that the particulars given above are true to the best of my knowledge and belief.

S.N. Bhalla

Publisher

All About Essential Plant Nutrients

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Kanpur—208002

The plants derive their nutrition from the soil and the atmosphere which includes that part of the atmosphere also which is below the soil. There are 16 elements which have special importance in this respect. They are, carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur, potassium, calcium, magnesium, iron, boron, manganese, copper, zinc, molebdenum and chlorone. The first three of these elements, the plants obtain from the atmosphere. The remaining 13 are obtained from the soil. All these 16 elements are considered essential for the plants. The essentiality of an element is determined by the following tests :—

(a) If the element is not available to the plant, the growth of the plant will either be completely suspended or reduced and the life cycle of the plant can not be completed unless the deficient element is supplied,

(b) the deficiency of the element can not be made good by any other element and the development of the plant will start only by supplying the deficient element,

(c) the deficiency of the element appears in a form of specific symptoms which are not produced by the deficiency of any other element; and

(d) the deficiency symptoms could be removed by supplying the deficient element.

The elements which a plant derives from soil are generally divided into two groups. This classification is based on the amount of the element required by the plants. The elements which are required in larger quantities are known as 'major' or macro element and those which are required only in small quantities are known as 'minor' or 'trace elements' or 'micro nutrients'.

Macro nutrients

1. Nitrogen (N)
2. Phosphorus (P)
3. Potassium (K)
4. Calcium (Ca)
5. Magnesium (Mg) Secondary nutrients
6. Sulphur (S)

Micro nutrients

1. Iron (Fe)
2. Boron (B)
3. Manganese (Mn)
4. Copper (Cu)
5. Zinc (Zn)
6. Molybdenum (Mo)
7. Chlorone (Cl)

The essential elements could be classified on the basis of structural and nonstructural elements and also on the basis of their mobility within the plant. The structural elements are those which enter into the composition of the plant-tissues. In this group are included all the macro elements except potassium. As for instance, Ca enters into the composition of cell wall in the form of calcium pectate. Nitrogen, phosphorus and sulphur are present in the nucleus of the cell. Magnesium and nitrogen are part of the chlorophyll molecule. The micro nutrients, on the other hand, are non-structural element and generally function within the cell as catalyst.

On the basis of mobility within the plants the following classification is possible.

(a) *Mobile*—Nitrogen, phosphorus, potassium, sulphur and chlorine.

(b) *Partially mobile*—Zinc, copper, manganese, molybdenum, boron and Iron

(b) *Immobile*—Magnesium and calcium.

The deficiency symptoms of the mobile elements first appear on the older leaves because they are translocated from the older leaves towards the younger growth. On the contrary, the deficiency symptoms of immobile elements appear first on the plant organs where new growth is taking place.

The role of the different essential elements in the life of a plant is as follows :—

Major or Macronutrients

1. Nitrogen : Nitrogen is present in the cell protoplasm in the form of protein. It is also present

in the nucleus, chlorophyll, enzyme and harmones. This general distribution of nitrogen makes it one of the most important element in the life and development of plants. In the absence of nitrogen photosynthesis stops and no vegetative growth takes place and there is a general yellowing of the foliage. This element is particularly lacking in our soils. The humus and organic matter of soils are its main source. A small quantity of nitrogen comes alongwith the rain in the form of nitric acid. Besides, the fixation of atmospheric nitrogen is also brought about by symbiotic bacteria in the root of leguminous plants. Some non-symbiotic nitrogen fixation also takes place by a group of soil organisms specially Azotobacter.

However, from the various natural sources enumerated above, the addition of nitrogen to the soil remains very small and inadequate for crops production. Artificial fertilization of nitrogen, therefore, must be taken to get the optimum yield particularly in view of the fact that this is the one element to which crop responses have been universal and substantial.

Phosphorus

Like nitrogen, phosphorus is also present in the cell protein. It has special importance in carbohydrate and fat metabolism. In the development of different plant parts, it has the following roles to play :—

(i) It helps in development of lateral roots,

(ii) In cereal crops it promotes tillering,

(iii) In its presence crops mature early and the seeds become bold. It is essential for seed formation.

(iv) Phosphorus gives strength to straw and helps to prevent lodging.

(v) Phosphorus increases the ratios of grain to straw in cereals.

Besides, it is specially important for the cultivation of leguminous and oilseed crops as it helps in symbiotic nitrogen fixation and synthesis of oils and proteins. Plants take it in the form of phosphate ion.

Phosphorus starved plants have a stunted and poorly developed root system. Fodder crops grown on phosphorus deficient soils contain reduced amount of this element and thus are inferior to live stock. A deficiency of phosphorus quite often does not become apparent through reduction in yields. The phosphorus nutrition is, therefore, critical. The supply of phosphorus is usually low and is of the order of 0.1 percent of which a minute fraction only is available to the plant. Besides, there is the problem of fixation of applied phosphorus. In strongly acid soils, it gets fixed up as iron and aluminium phosphate and in calcareous soils tricalcium phosphate is found resulting in the reduced availability of phosphorus in soil.

In crop production, therefore, not only the artificial fertilization with phosphorus is important but the method of application is also important. Placement has been advocated as the best method of application in all types of soils.

Potassium

Potassium is absorbed is potassiumion and is found in soils in varying amounts, but the fraction of total potassium in the exchangeable form is usually small. Plant requirement of this element is quite high and when potassium is present in short supply characteristic deficiency symptoms appear. Potassium is a mobile element and as a result the deficiency symptoms usually occur on the lower leaves of annual plant in the form of marginal chlorosis followed by marginal necrosis.

Unlike nitrogen, sulphur and phosphorus, Potassium apparently does not form integral part of plant components. It functions mostly as catalyst. It has the following functions within the plant.

(1) Carbohydrate metabolism or formation and break down and translocation of starch.

(2) Nitrogen metabolism and synthesis of proteins.

(3) Activation of various enzymes.

(4) Maintenance of adequate water relationship in plants.

(5) Strengthens straw of grain crops.

(6) Promotes disease resistance in the plant.

Potassium deficiencies greatly reduce crop yield even before the appearance of visible symptoms. This phenomenon has been termed as hidden hinger and may be exhibited in the case of other element also.

Potassium has a balancing effect on the proper utilization of nitrogen and phosphorus. Consequently for optimum crop production potassium fertilization has assumed importance.

(*Contd. on page 25*)

PROTECT YOUR TOBACCO FROM DISEASES

G. Arjunan

Tapioca Research Station, Salem, Tamil Nadu

Tobacco is an important cash crop in India. It is used for making cigarettes, cigars, cheroots and bidies and for hookah, snuff and chewing. India ranks third in world tobacco production and second in world exports of flue cured tobacco. It fetches over sixty five crore rupees in foreign exchange and ranks second in revenue earnings among excisable commodities in India. During 1973-74, the total area under tobacco in India was 446.5 thousand hectares. Production of tobacco during 1973-74 was 441.4 million kilograms. Tobacco crop is affected by over 20 different diseases. The important diseases of tobacco with their symptoms, and control measures are given in the following paragraphs. The yield of the crop can be increased by adopting suitable measures for control of diseases.

1. Damping off

Damping off of tobacco is caused by the fungi named *Pythium aphantdermatum*. In addition, *P. indicum* and *P. debaryanum* have also been found to be associated with this disease. It is of widespread occcurrence in tobacco seedbeds, where it causes much damage.

Symptoms: The fungi normally attack the stem at ground level, which is characteristically girdled by a ring of dead brown tissues. The plants topple over and the leaves rot into a shapeless shiny mass. Unchecked, the disease spreads out-wards, to leave circular patches of rotten material on the surface of the bed. All stages of seedling growth are susceptible. Occurrence just following germination can cause rapid disappearance of the stand without detection of the disease unless observation is very close. Conditions which predispose seedlings to damping off are overcrowding of seedlings, growth in damp localities, excess of water in soil and presence of too much decaying vegetable debris.

Mode of spread: The fungi perpetuate in soil attacking tobacco and other host plants. They produce chlamydospores and oospores, which help to survive adverse climatic and soil conditions. Under favourable conditions chlamydospores and oospores germinate, producing the asexual mycelial mass.

Control measures: Soaking seeds before sowing in 0.15% copper oxychloride gives better control of seed-borne infection. The disease is controlled by providing adequate drainage in the nursery. In nurseries, beds have to be raised 15 to 20 cm above the ground level to avoid stagnation of rain or irrigation water. Thin sowing of seeds avoiding overcrowding of seedlings keeps down the disease. Sterilization by dry heat is accomplished by burning trashes upon the surface of seed beds. Two sprayings in the nursery with Bordeaux mixture 1% or other copper fungicide, one before sowing the seed and the other a week after their germination, has given satisfactory control of the disease. Generally 700-900 litres of fungicides solution is required for an acre. Soil applicalion of thiram at the rate of 8-10 kg per acre is also effective in controlling the disease.

2. Black shank

This disease is caused by the fungus, *Phytophthora parasitica* var. *nicotianae*. It is also a common disease of tobacco in many parts of India, particullarly in heavy rainfall areas. The disease is seen generally immediately after transplanting.

Symptoms: The fungus primarily infects the stem and roots. The stem at the soil level begins to rot when the soft tissues are invaded by the fungus. The rotting of the tissue progresses in all directions resulting in the death of the seedlings. If the infected plants are older, the bottom leaves turn yellow, finally becoming black, shrivelled and drop-down from the stem. When split open, the stem will show dark brown or black cortical and pith tissues. The death of the affected plant is common. In some cases the pathogen attacks the leaves, producing watersoaked spots, which enlarge to blight the leaves. The disease may appear sporadically, affecting a few plants in the field but during humid weather it spreads rapidly to a majority of the plants in the field.

Mode of spread: The fungus survives in the soil on plant debris and infects tobacco through

roots. The disease spreads through irrigation water, wind, implements, cattle and human beings. Rainy weather and high humidity are main factors favouring disease incidence.

Control measures: Crop sanitation like collection and destruction of plant residues and debris helps in the control of the disease. Excessive irrigation should be avoided. Adequate drainage to prevent water stagnation in the field should be provided. Drenching the soil around the base of the stem with Bordeoux mixture (1%) or cheshunt compound will be effective. The fungicide should be poured over the stem so that soil is well drenched with the fungicide.

3. **Frog-eye leaf spot**

This disease is caused by the fungus, *Cercospora nicotianae*. It is a common disease of tobacco in India causing considerable loss.

Symptoms. The disease affects often the lower and more matured leaves. On the leaves small reddish circular spots appear and they become bigger in size and develop ashy white or pale brown centre surrounded by brown bands. The spots size may vary from 5-10 mm in diameter. Occasionally the white centre is absent, with the result the spots may resemble those caused by angular leaf spot but grey or black fructifications can be seen. Several spots coalesce and become irregular causing drying of the affected tissues. Spots are also formed on bracts, calyx and capsules. During favourable weather conditions the disease proves to be destructive. Both the yield and quality of the tobacco are reduced by this disease.

Mode of spread: The disease is primarily seed-borne. The disease first appears in the nursery and the primary infection originates from plant debris. Transplanted seedlings previously infected by the disease carry the inoculum to the main field where disease spreads quickly during favourable climatic conditions. Close planting and frequent irrigation provide high humid conditions at the basal portion of the plant favouring quick spread of the fungus. The secondary infection is by wind-borne conidia.

Control measures: Treatment of seeds with 0.1% silver nitrate solution followed by washing with water and proper drying of seeds should be done. Seed treatment with 0.25% thiram is also effective. Overcrowding and excessive soil moisture should be avoided. Disease free seedlings should be used for planting in the main field. Sanitary measures like removal and destruction of the plant refuses will be helpful in checking the disease. Spraying with Bordeaux mixture 1% or copper fungicide 0,25% or Dithane Z-78°. 2% at 2-3 weeks intervals both in the nursery and in early stages of transplanted crop effectively controls the disease.

4. **Powdery mildew**

This disease is caused by *Erysipha cichoracearum* var. *nicotianae*. The disease is common in Tamil Nadu, Andhra Pradesh, Karnataka, Bihar and West Bengal causing considerable losses.

Symptoms: The leaves show distinct white patches of fungal growth. The patches enlarge covering large areas of leaf surface and become powdery. The powdery growth is seen on the lower surfaces. The affected leaves turn yellow and brown later and wither when the leaves are covered by dense fungal growth. The infection generally starts on lower leaves and spreads to the upper leaves. The disease causes severe reduction in quantity and quality of the yield. The infected leaves if cured, become black having little market value.

Mode of spread: The fungus spreads mainly through airborne conidia. The conidia requires dry atmospheric conditions and is commonly found when black shank and leaf spot diseases are absent. Shady environment favours the development of the fungus. Excessive application of nitrogen induces higher disease incidence. This disease appears during November-February.

Control measures: Wider spacing should be adopted to have more sunlight and ventilation. Excessive doses of nitrogen should be avoided. The basal leaves should be removed and sulphur at the rate of 18 kg/acre should be applied on the soil around the base of the stem. Sulphur should never be applied on the leaves.

5. **Brown spot**

Brown spot of tobacco is caused by the fungus, *Alternaria longipes* (—*Alternaria tenuis*). This is another leaf infection of wide occurrence in tobacco growing areas. Severe epiphytotics have occurred in Rhodesia since it first became a problem in 1931.

Symptoms: The disease appears first on the lower leaves as small, circular, dark brown spots on good-bodied leaf, but may be quite light in colour

(*Contd. on page 26*)

GREAT MEN SPEAK

Never should we make the mistake of imagining that sin can be classified as "big" or "Small".

Mahatma Gandhi

One man commits a theft, another aids and abets it, while another one only harbours the intention to commit it. All the three are thieves.

Mahatma Gandhi

He who thinks, speaks and acts with God as his witness will never feel ashamed of doing the right thing.

Mahatma Gandhi

He who doubts the existence of God perishes.

Mahatma Gandhi

Happiness eludes us if we run after it. In fact, happiness comes only from within. It is not a commodity to be bought from outside.

Mahatma Gandhi

He alone can be said to have conquered anger who is not angry even when there is a cause for anger.

Mahatma Gandhi

Flout one rule and all rules are flouted, for they all have one basis-breach of any rule is a breach of self control.

Mahatma Gandhi

Man cannot worship God and at the same time despise his fellow beings.

Mahatma Gandhi

European civilisation is no doubt suited for the Europeans but it will mean ruin for India, if we endeavour to copy it. This is not to say that we may not adopt and assimilate whatever may be good and capable of assimilation by us. It does not also mean that even the Europeans will not have to part with whatever evil might have crept into it. The incessant search for material comforts and their multiplication is such an evil, and I make bold to say that the Europeans themselves will have to remodel their outlook, if they are not to perish under the weight of the comforts to which they are becoming slaves. It may be that my reading is wrong, but I know that for India to run after the Golden fleece is to court certain death.

Mahatma Gandhi

In our national concerns we adopt democracy not merely as a political arrangement but as a moral temper. It is of a piece with our great tradition and habits of behaviour. We realize that freedom has no meaning save in the context of equality and there can be no equality without economic justice. These ideals of freedom, equality and justice are not possessions to be defended but goals to be reached. We have often lapsed from them and suffered in consequence. In a mood of humility and national repentance, we should strive to correct our past mistakes, remove the indignities which we have imposed on our fellow men and march forward. We cannot move into the future by walking backwards.

Dr. Radha Krishnan

The qualities of heroism, valour and creative enterprise revealed during the period of our struggle for freedom are still called for. They are needed more today because we are engaged in the important task of national reconstruction. We have been trying to transform radically the social, economic and cultural life of our people. We have done much to expand and develop agriculture, industry, and transport on land, sea and air. Our languages, paralysed for centuries, have become alive. And there is yet much to be done. The way ahead is long and difficult, strewd with pitfalls and dangers. Our economy is not yet self-supporting, we have not yet secured for our youth education and the social standards required for the continued maintenance of our spiritual and moral standards which are essential for our progress.

We have our share of grave and even dangerous faults and blemishes which we should try to over come. In the recent election complaints have been made that there is a general decline in integrity, even good manners. Some of us in high places are obsessed by the pursuit of power and profit by means not always honest but sometimes even shady, and by the craving for easy and comfortable careers and superficial luxuries at the exdense of national interests. It is sad to hear that students do not get admission without recommendation. Even regular promotions in services cannot be had without influence. These

complaints may be highly exaggerated, but we should be on our guard: Corruption and nepotism are bad but acquiescence in them is worse.

Dr. Radha Krishnan

Thus we see that people who are in the elementary stages can often rise to the greatest heights, if they are as good as their word; if they are sincere and earnest; if they do not want to make promises with God and then break them. When once in the temple or church, they say, "I am Thine," let them feel it. Let them live it. Let them realize it. This is true religion.

Swami Rama Thirtha

Within you is the real happiness, within you is the mighty ocean of nectar divine, seek it within you, feel it, feel, it is here, the self. It is not the body, the mind, the intellect; it is not the desires or the desiring; it is not the objects of desire; above all these ye are. All these are simply manifestations. Ye appear as the smiling flower, as the twinkling stars. What is there in the world which can make you desire anything ?

Just sing, just chant OM and while chanting it, put your whole heart into it, put all your energies into it, put your whole soul into it. Put all your strength in realizing it. The meaning of this syllable OM is "I AM HE", "I AND HE ARE ONE," OM, "THE SAME AM I." OM, OM. While chanting, be conjuring up, if possible, before your mind all your weaknesses and all your temptations. Trample them under your feet, crush them out, rise above them and come out victorious.

Swami Rama Tirtha

It is obovious that an ignorant and illiterate nation can never make any solid progress, and must fall back in the race of life. What we, therefore, want—and want most urgently-is first of all a widespread diffusion of elementary education, effective and comprehensive system of primary schools for the masses; and the longer this work is delayed, the more insuperable will be our difficulties in gaining for ourselves a recognised position among the nations of the world.

Gopal Krishna Gokhale

Water purifies the body ; Truth purifies the mind ; knowledge is improved by constant endeavour and perseverence ; human body is useful only when soul is there ; intellect develops with the acquisition of knowledge.

Manu Smriti

Wise men do not bear grudge against each other nor do they quarrel between themselves. A wise man also does not fight with a fool. If a stupid person, in his madness, speaks harsh words, a wise man tries to satisfy him in pleasant terms.

Persian poet Saadi in "Gulistan"

Jealous, full of hatred for others, uncontented, easily getting into temper, suspicious, living on the earnings of others ; such six types of persons are always unhappy and have no peace of mind.

Hitopadesh, Mitralabha-25.

The qualities of a person who could be called a friend are, purity of heart, habit of sacrifice for others, courage, remaining unperturbed both in happiness and in distress, broad-mindedness, affection and truthfullness.

Hitopadesh, Mitralabha-96

He, whose power of thinking does not get vitiated even when afflicted by all kinds of miseries, does eventually overcome his difficulties and misfortunes.

Panch Tantra,

The habit of giving in charity to deserving persons is the biggest quality and possession of a man. There is no bigger enemy on earth than greed. Good character is the biggest ornament and contentedness the biggest wealth.

Panch Tantra

It is not we who have enjoyed the pleasures of the world ; the pleasures have in fact enjoyed us—eaten us up. We have not done any penance but have only been burning ourselves. It is not the time that has been finished ; we ourselves have been finished. It is not our desires that have grown weak with the passing of time; we ourselves have grown old and weak.

Bhartri Hari, Vairagya Shatkam-12

With the advance of age the face has been disfigured by wrinkles. Head has grown gray like white clouds. All the organs have grown old and weak. The desire and greed, however, continue to be ever strong.

Bharatri Hari, Vairagya Shatkam-14

When I had only a limited knowledge I felt intoxicated like on elephant, thinking that I knew every thing. My mind was then full of vanity. But when I came into contact with learned people, and actually learnt a little, I felt I was a fool. My fever of vanity then left me.

Bharatri Hari Niti Shatkam-8

Quality Seed Production, Seed Storage and Packaging Aspects

Dr. D.P. Singh

Chairman, NSC & SFCI

Agricultural progress is the key to the growth and prosperity of the Indian economy. Quality seeds of high-yielding varieties are the key to agricultural progress. Quality seeds are, thus, a key to the growth and prosperity of India. It is the production potential and other desirable characteristics of the seeds that set the limit to agricultural progress; and the other inputs, such as, fertilisers, pesticides, weedicides, labour and capital etc. only help in the realisation of the production potential of the seeds. Hence the seed can be rightly described as the most important single input of agriculture.

It is the general opinion that the most significant development of the century is not the discovery of the nuclear energy and its multifarious uses but the discovery of hybrid vigour and dwarfing genes, which have converted plant breeding into a manufacturing art. Thanks to these discoveries, as also the numerous other developments in agriculture a large number of high-yielding varieties of crosspollinated as well as self-pollinated crops have made their dramatic appearance on the scene during the last decade or so. The impact of these varieties has been so far-reaching that the unprecedented increase in the yields of some crops, particularly wheat, have been designated as a 'green revolution'. The seeds that enjoy very high yield potentials, can be rightly described as the 'seeds of green revolution'.

The seeds, if they are of the right variety and of the right quality, can be a source of immense good. On the contrary, if the variety is not right or the quality is not good. they can also be a source of immense evil. This may be illustrated by reference to a recent experience during a visit to a country, which has become rich due to discovery of oil in the Sahara Desert and which is otherwise regarded as quite dynamic. Several hundred large-sized tube-wells have been sunk in the Sahara Desert area of this country with potential supply of good quality water. This promises to be a boon to the Sahara Desert, which has fertile virgin land extending over hundreds of miles at a stretch. A delegation from India was invited to study the conditions on the spot and explore the possibilities of a joint venture for agricultural production around these tube-wells. When we visited the area, we saw the pearl millet crop around half a dozen tube-wells. Though cultivation was being carried out for the first time in the area, we noticed rat borrows, green and brown caterpillars and other insects, weeds and diseases. On enquiry we found that ordinary good-grain had been used as seed in this area, which had not seen any living plants, insects, rats and other living organism for millions of years. The rats, insects, weeds and plant diseases had all come with the seeds. You can very well see how much harm inferior quality of planting material or so called seeds can do. The paramount importance of quality of seeds can hardly be over-emphasized. All our efforts are likely to be of little consequence if the quality of the seed is not ensured.

The quality of seeds depends on numerous factors, such as the quality of the breeder and nucleus seed used for the production of foundation seed and quality of the foundation seed used for the production of certified seeds, the suitability of the agro-climatic conditions and freedom from various hazards, such as floods, drought, water-logging etc; the care and caution taken in the field while growing the seed crops as well as processing and, last but not the least, storage and packaging.

In order to bring about complete self-sufficiency and self-reliance in seed production to meet the full effective demand for quality seeds of high-yielding varieties, along with an adequate buffer-stock, as an insurance against vagaries of weather, and also a substantial export potential a National Seeds Programme is being launched. The programme aims at a five-fold increase in the production of quality seeds on the base level of 1973-74 to 3,00,000 tonnes by 1980-81. The maximum emphasis is being placed

on attaining and maintaining the highest standards in quality. It is a truism to say that the programme will stand or fall with the quality of seed.

It is for this reason that the Agricultural Universities and other research institutions have been assigned the place of pride in the organisational structure of the Programme so as to utilise their technical services to the maximum possible extent. For the same reason, the compact areas approach has been adopted to provide the necessary concentration of technical and institutional services of the highest order down on the spot. The service agency system and growers' participation as share-holders have been incorporated in the Programme to provide the maximum incentive to the growers to maintain good quality. Regular seed testing at various stages such as, before the acceptance of the raw seed, after the receipt of the raw seed but before processing, and after processing but before tagging, as also grow-out tests after distribution, have been included in the Programme. The seeds carry a complaint card in every bag, which the farmer can send without affixing any postage and to attach small packet of seed so that the farmer can test the germination of the seed on his own ahead of sowing.

All these measures, important as they are, will be of no avail if adequate and suitable arrangement is not made for storage and packaging on which depends the viability of the seed before it is used by the farmers. They are of particular significance in a country like India with high humidity combined with high temperatures in numerous end-use area.

Timeliness and proper scheduling of field operations alone can ensure preservation of seed quality in the field before harvest. Proper physical facilities and structures are necessary for postharvest storage, i.e., beginning immediately after harvest to the time seed is sown. The different stages of total seed storage may be listed as follows in sequential order :—

(a) Storage of raw seed during the period between drying or threshing and cleaning;

(b) Holding storage during the period between different steps in processing and from processing to packaging;

(c) Packaged seed storage;

(d) Transit storage;

(e) Market place storage; and

(f) Farm storage during the period from purchase to planting.

As the greater production of seeds is consumed in areas where storage conditions are, difficult, it is necessary to develop a series of stores in favourable climatic areas intermediate between the processing plants and the points of consumption. The National Seeds Programme has made a provision of Rs. 86.86 millions for the construction of large-sized stores at half a dozen nerve-centres of communications. All this will take care of only half the storage requirements, the other half being provided as part of the seed processing plants in the form of silo storage and bagged storage in equal portions. Rake movement from the seed processing plants to the large-sized stores in full or half-train loads is expected to keep down the cost of transport.

The storage provided at the seed processing plants and the large-sized stores will, however, not be enough. Storage is also required to be very close to the final point of consumption to ensure a smooth flow of seeds to the dealers and the farmers. Sixty-nine transit stores are proposed to be set up at selected points in the country. These transit seed stores, which will store relatively smaller quantities for short periods of a few weeks, will be located in such a way as to cater for the needs of 200-300 dealers.

The stores at the seed processing plants, bulk stores and transit stores are expected to cater for the needs of food and fodder and fibre crops. Potato and vegetable seeds will, however, need special kind of stores. Likewise the requirements of the foundation and nucleus seeds will also be for storage of special kind.

The following aspects concerning storage and packaging are of particular interest to all those concerned with the production, processing and marketing of seeds :—

(i) Causes of deterioration of seed in the field, transit, processing, and storage and their solution.

(ii) Drying of various seeds with particular reference to vegetable seeds.

(iii) Maintaining seed viability in storage i.e. seed drying, seed moisture control, use of insecticides, fungicides, their effect in relation to seed germination and dosage.

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Harvest A Rich Crop of Summer Moong

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After the harvesting of potato, sugarcane, mustard, wheat, barley and other *rabi* crops the fields remain fallow till the onset of *monsoon*. Where irrigation facilities are available, these fields may be utilised for raising fodder crops, vegetables and *moong*. The cultivation of former two groups of crops depends upon the demand and the market facilities. On the other hand, *moong* may be raised in any region and locality. Raising of *moong* is an economic proposition as it utilises the fallow fields between *rabi* and *kharif* crops, engages the labourers, enriches the soil fertility and gives handsome returns. It is, therefore, essential to bring summer fallows under *moong* cultivation in the personal as well as national interest. The following guidelines are given for raising a successful crop of *moong*.

Sowing time

Sowing may be done from middle of March to middle of April as and when the fields become available after the *rabi* harvest. When the crop is sown beyond this period, the growth of the crop is checked up on account of high temperature and strong surface winds, yield is reduced drastically and the maturing crop is often caught by early monsoons rains.

Preparation of the field

The field should be prepared soon after the harvesting of *rabi* crops. Such fields should be given pre-sowing irrigation (i.e., *Palewa*). When the fields come in condition, ploughing should be done two or three times. One should not bother for making fields well pulverised as too many ploughings may delay the sowing and also result in loss of soil moisture. Full dose of fertiliser recommended to this crop should be incorporated in the soil at the time of last ploughing. The field should be made level by planking in order to make uniform distribution of irrigation water. The planking should be done as early as possible for retaining ample moisture in the soil.

Fertilizer application

Being leguminous crop it meets its nitrogen requirement by fixing atmospheric nitrogen in the soil with the help of specific bacteria known as *Rahizobium*. These bacteria start functioning when the plants get established in the soil. For reaching this stage the plants need a small starter dose of nitrogen. Fifteen to twenty kilograms of nitrogen is enough for one hectare of land. If the field was under wheat or potato which had received higher dose of nitrogen, the quantity of nitrogen to be given to the crop may be reduced. Application of phosphatic fertilizer is essential as it promotes the multiplication of bacteria and also improves the nitrogen fixation. A dose of 40-50 kg of P_2O_5/ha is enough for this purpose. If the previous crop had been fertilised with higher dose of this fertiliser, this quantity may also be reduced as in the case of nitrogen. The full dose of phosphatic fertiliser should be drilled in the soil before sowing. Di-ammonium phosphate is an ideal fertiliser for this pulse, as it meets the nitrogen and phosphorus requirement of the crop in full and can also easily be placed in the soil. One quintal of this fertiliser is enough for one hectare of land.

Varieties

Selection of appropriate varieties is an important step for getting high yields. Only early maturing types which would mature in 60-70 days should be grown during this season. Varieties T_1, T_{44}, *Pusa Baisakhi*, PS. 7, PS 16, S 8 and G 65 are generally recommended for summer season. Varieties Jalgaon 781 for Central and Peninsular regions and B_1 for Eastern region of the country are also promising and may be taken up in the respective parts. Due to lack of synchrony in maturity 2 to 3 pickings of the pods would be required. PS 7 is fairly synchronous in maturity and therefore, the pods may be picked in one lot or the plants can be harvested like other crops.

Rhizobium culture

Presence of efficient strain of rhizobium culture in the soil is essential for better fixation of atmospheric nitrogen and so the better crop growth. If the fields are being sown with *moong* crop for the first time or after a long gap, the use of rhizobium culture results in 10-15% increase in yield. Even

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Triticale In Barani Areas

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The consistent untiring efforts of plant scientists led to the evolution of a new crop-named Triticale. For the first time it was reported in 1875 as a hybrid of wheat and rye (*Secale cereale*) which was male sterile. This remained the focus of attention of plant scientists in the early ninteenth century who ultimately succeeded and changed the sterile hybrid to fertile one and named it as Triticale. This new cereal, undoubtedly, inherited many good characters of its parents but at the same time carried some undersirable characters which have now been eliminated to a large extent. The present lines of triticales are nutritionally better than wheat and possess amazing power to withstand cool and dry climates.

Barani (dry land) areas, which are characterized by low, uncertain and variable rainfall, pose a serious problem for crop husbandry due to inadequacy of soil moisture. The limited soil moisture leads to poor plant stand. The germinated young plants will frequently resulting in poor growth and development. Consequently crop failure, low yield and unstability in production become a common feature of moisture scarcity areas. A practical approach to meet such adverse situations would be conservation of more moisture in the soil, reducing wasteful loss of soil moisture and orientation of crop management practices so as to make the most efficient use of available water.

Of crop management practices, selection of suitable crops and their varieties, is perhaps the easiest method and does not involve extra expenditure. During *rabi* season, wheat, barley, gram, *toria*, linseed, safflower and sunflower are important crops to be grown in *barani* areas. Among these, the short duration and deep rooted pulses and oilseeds are, undoubtedly, more suited for moisture scarcity zones. However, the vital need of growing cereals alongwith other crops for making the country self-sufficient in food can not be over-emphasised. Wheat and barley are major *rabi* cereals. Of this, wheat fails to give remunerative yield under high soil moisture stress and dry weather conditions. Barley, though does better than wheat, is not widely acceptable by common man due to its poor grain quality. The choice is left to cultivators of triticale as it possesses better baking and *chapati* making quality and its yield is fairly high.

Triticale is new introduction to India. Suitable varieties for different agroclimatic conditions of the country are yet awaited. However, the preliminary trials with promising lines are quite encouraging. In a field trial during *rabi* 1974-75 at Pantnagar, three wheat varieties viz Pratap (HD 1981), Kalyan Sona and C306, one barley variety-Ratna were compared with triticale lines Armadillo PM 307. It was interesting to note that triticale Armadillo PM 307 gave higher yield than best wheat and barley varieties under unirrigated shallow water table conditions. Triticale produced 41.5 Q grain as against 39.3, 36.2, 28.7 and 37.9 Q/ha by Pratap, Kalyan Sona, C306 and Ratna, respectively.

Some of the morphological features and growth behaviour of triticales important for *barani* areas are discussed below.

Suitable for early sowing:—One of the formidable barriers for success of dwarf wheat in *barani* areas is its unsuitability for early sowing. If sown early in the season, the reproductive phase of the plant is attained untimely resulting in poor yield. On the other hand, when sowing is arranged at optimum time, the residual soil moisture carried from the preceeding monsoon is depleted from surface soil making the land unfit for germination of seeds. This highlights the value of crops suited for early sowing without having adverse effects on their growth and development in dryland areas. Triticale is fit for early sowing. Results of a field experiment conducted during *rabi* 1974-75 at Pantnagar, where a few triticale lines were tested alongwith wheat by arranging sowing on different dates, clearly show its merit. When sown on 20th October, wheat check C306 and Sonalika Produced 21.9 and 28.5 Q grain/ha whereas triticales Armadillo PM 113 and Armadillo PM 312 produced 38.1 and 37.1 Q grain/ha, respectively. Similarly, on 4th November sowing, wheat varieties UP 310 and Sonalika produced 36.0 and 34.0 Q grain as against 38.8 and

(*Contd. on page 29*)

Twenty Weeks To Egg Profits

The chicks or the eggs ? Which one was first may not bother you as a poultry farmer. But most of you do start counting the eggs, the day the chicks, mere quivering balls of soft feathers, break out of their shells.

You are probably not too unrealistic, for even though these chicks will take about 20 weeks to come to lay, the process of egg production begins the day a chick is hatched. However, the number of eggs one can put in the basket will depend on what care has been bestowed on them. Any set-dack during these weeks—chilling, over crowding, malnutrition and disease will affect their laying capacity.

This is why it is always good to buy day-old birds, even though ready-to-lay pullets bring in immediate returns. But then you wouldn't know whether these have been reared carefully.

Chicks can contact a number of infections in a badly-run batchery. It is better to order your supply from a reputed poultry farm.

It is now common to rear the chicks artificially in farms. A sound rearing or brooding programme should provide ideal conditions for the delicate chicks to grow, till they can adjust to the surroundings.

Where will you house the Baby Chicks ?

The chicks should be reared in a house which is away from the layers. It will be better if the house is so located that the breeze first passes through the chick-house. If the breeze comes from the direction of the layer-house, the chicks, sensitive as they are may pick up infection from the air. For, the layer, house may be having a few carriers.

The house must be washed, scrubbed, disinfected, especially, if it has been previously used. So also the feeders and waterers. It may be kept unoccupied for about 20 days. Spread fresh clean, dust-free and dry litter on the floor five cm high.

Two days before

Check all lights. See whether it is well-protected from rats and birds. Get a supply of fresh feeds, Old feeds can carry infection. One or two days before the chicks arrive, the brooder must be started at 35°C (95°F), five contimetres above the littre layer. Chicks need to be kept warm for the tender six weeks of their lives. The brooder will be required for a month or so.

Chicks have come

Are they fluffy and dry ? If yes, they have had a good journey. Place them under the hover and feed at once. Cold chicks will not eat or drink. Baby chicks need all the warmth to keep growing. In the beginning they will need 95°F (35°C.)

Make them comfortable

The temperature can be gradually reduced keeping an eye on the comforts of the chicks. Reduce it by 5°F every week (1.8°C) till the temperature is almost equal to the outside. The temperature is measured by placing thermometer five centimetres above the litter layer. By watching the birds one can tell whether they are comfortable and adjust toe temperature accordingly. If they are crowding along the wall and are pilling. they are too hot. If you find them hudding and pilling in groups, then they are cold. All is well if the chicks are well spread out over the floor and at feeder and waterer. When its temperature is the same as that of the outside, use it only at nights during the last two weeks, if needed. To help the chicks keep to the brooder area put a chick guard of hard board or corrugated cardboard 60 to 90 cm away and fasten the joints. Once the chicks start jumping over the guards remove them, but round off the corners of the room with the cardboard so that the chicks do not huddle in the corners.

The Nourishment

Start them on mash and not scratch grains. This will give them a good start. Withholding grains till

they are six weeks old has yielded good results. In deep litter house, the chicks can be encourage to pick the feed by spreading it on the wide-mouthed box lids spread on a newspaper.

The feeder when introduced can be placed partly under the brooder within the guard space. To start with, fill the feed hoppers, to the brim. Thereafter, keep it only two-thirds full. Bigger feed hoppers must be provided as the birds grow.

Better feed often. To prevent the chicks getting into the feeder and pilling, use suitable guards over the troughs of tube feeders. Spread a pice of card-board or wood under each feeder to discourage the birds from scratching the litter into the feed.

For 100 chicks, up to two weeks, provide 8 to 9 feet of space at the feeder, give 15 feet at four weeks and 20 feet at 8 to 10 weeks. Count both sides of the trough. Check the growth and the consumption rates. Gradually put them on to grower mash in six to eight weeks.

The Drink

Did you know that the birds need a drink every 15 to 20 minutes ? To begin with, provide two four-litre contains per 100 chicks. They will need 8 litre-waterers, when 10 weeks old. If the water is spilled over, the wet litter must be removed and dried. You can arrange the feeders just like the spokes in a wheel around the brooder and place waterer in-between.

Fresh Air

Poultry-keepers often complain that chicks raised on deep litter are troubled in the eyes. This may be due to the ammonia gas produced due to fermentation of droppings and litter. This will never happen if the room is well-ventilated. For healthy growth, fresh air is as essential for the chicks as the food and drinks. The house should neither be too dry nor too wet. Too much of [dryness can lead to poor feathering. If too wet, the litter will be dampy and the chicks might get coccidiosis.

Enough Leg Space

A good rule is to allow not less than one square foot of space per chick up to 10 weeks of age. If the space is short, half a sq. foot can be given up to 4 to 6 months and doubled thereafter.

Chicks in small groups are best cared. Nor more than 300 chicks should be kept under one brooder.

Continuous light is needed up to eight weeks. At first a dim light (40 watt) may be fitted below each hover. This will attract the birds to warmth and feed. When the brooder is removed 40 watt bulb for every 100 sq. feet of floor space should be provided.

Artificial light at night will help the chicks eat more at that time. The practice will pay in summer as they do not like to eat during the hot days.

It is advisable to get the day-old chicks vaecinated against Ranikhet disease. Some hatcheries supply vaccinated chicks on extra payment. Give the second vaccine at about 9 to 12 weeks. The Veterinarian can tell you what vaccines to give and at what time. It is advisable to have a gap of 10 days between the two vaccines to avoid stress. Always deworm the birds before vaccinated. De-worming should, in fact, be done as a routine every 6 to 8 weeks.

All is well ? Are the chicks eating and drinking well ? Still you you cant's take it easy.

There may be some birds not coming up well. Cull out chicks with unheated navels and any deformity and also the weak ones. Remove the diseased ones as they will infect the others. Culling saves on feed.

Sudden deaths, bloody droppings on the litter, pale beaks, ruffled feather and trembling indicate that the birds are attacked by one disease or the other. Treat the sicks chicks immediately with the help of a Veterinarian.

Your watchful eyes and how you handle your delicate charge will count most in turning the baby chicks into best layers. If you are ready, count your profits right now by all means. (F.I.U.)

Every thing comes to us from earth ;
Every thing goes back to it.
Knowledge and labour bring their fruits.

J. Bujault

Poultry Ectoparasites And Their Control

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Poultry birds are attacked by a wide variety of ectoparasites which range from temporary non-specific parasites like mosquitoes to specific parasites like poultry ticks, mites and lice which spend their entire life on the birds and are closely restricted to poultry or related wild fowl. It is estimated that more than fifty per cent of the birds are lost annually due to diseases and pests. The control of poultry ectoparasites presents a more difficult problem than other livestock essentially because poultry birds are more sensitive to the toxicity by pesticides used on them. Moreover, pesticide contaminated poultry products will be hazardous to the health of the human consumers. Naturally, therefore, pesticides should be used on birds to as minimum an extent as possible and only those pesticides should be used which are safer to warm blooded animals. In order to minimise the use of pesticides on poultry birds the poultry farmer should use better management practices keeping in view the life cycle and the habits of the various ectoparasites that attack the birds. The previous recommendations of using DDT and BHC for direct application on the birds should be avoided as it has now been conclusively proved that DDT accumulates in their body fat and may be carried in the eggs of treated birds, thus, causing health hazards to the consumers. During recent years a number of safer and better chemicals have been discovered but the information about them is widely scattered. The objective of this article is to summerise all the recent informations and recommendations for the benefit of poultry farmers.

(1) Poultry Lice

Lice is the most common external parasite of poultry. It is small wingless insect, grey or yellowish in colour with flat body from top to bottom and possesses blunt head and six legs. It spends its life on the host birds moving about with absolute freedom. It is very prolific and one pair of lice may produce 12,000 young ones within a few months. The eggs are laid on the body and are attached to the feathers in clusters or nests.

There are two kinds of lice viz. the body lice and the head lice. The body lice live mostly under the wings and around the vent. The head lice are confined to the head and the neck.

Damage and smptoms : The lice cause constant irritation to the birds and keep them restless. The birds lose sleep and appetite and consequently the egg yield goes down. In acute cases the infested fowls appear drowsy with drooping wings and ruffled feathers. Young chicks may die of a heavy infestation.

Prevention and control , All types of poultry lice can be easily controlled by insecticides. Treatment with them should be repeated till the parasites and their eggs are completely destroyed. The following control measures are recommended :

1. Nicotine sulphate (40% solution) should be painted on the perches at about sunset when the birds go to roost. The fumes emitted kill the lice.
2. Treat the walls ceilings and fixtures etc. with 1% malathion spray. While making this treatment, birds should be left in hen houses.
3. Treat the housing with 4% malathion dust at the rate of 1 kg per 300 sq. feet of floor space to deep litter floors. This gives a very effective and lasting control of the poultry lice.
4. The roosts should be painted with 3% malathion or 1% lindane solution in oil at the rate of 0.5 littre/100 linear feet of roosts. If solution in oil is not available, 1% water spray of lindane enough to wet the roosts completely may be useful.
5. Heavily infected birds should be given a bath in insecticide solution. For this purpose the insecticide solution should be made in warm water with 30 gms. of sodium floride in 5 litres of water or 10 gms of derris in 5 litres of water. The heads of the birds should be dipped only once very quickly while rest of the body should be dipped for about one minute. Treating the

birds with 2.5% of malathion dust also controls the lice effectively.

(2) **Poultry Fleas**

Poultry fleas are very small, active, jumping insects with 3 pairs of legs and are dark brown or blackish in colour. They are found in clusters and keep their heads embedded in the skin, so that they can not be easily brushed off. The body of the flea is flat from side to side. Three species of fleas generally affect the poultry. Of these the stick flea is the most common in India.

Damage and symptoms : The fleas are most abundant around the comb, wattles and eyes of the birds. Young birds are often killed. Egg laying capacity and growth of adult birds are greatly checked by the loss of blood and the irritation of their bites.

Prevention and control: It is advisable to keep the dogs, rats and cats away from the birds as they may spread the infestation. However, if the infestation has already taken place the following measures should be adopted to control it :

1. Fleas often breed in the soil and in order to stop their breeding, it is advisable to treat the floor of the hen houses with salt water. Birds should not be allowed to eat the salt as it is toxic to them.
2. If the infestation is high effective control can be achieved by treating the litter, ground and the floor with 4% malathion dust at the rate of 2.5 kg per 100 square feet or 1% malathion spray enough to completely wet the treated surfaces. This method provides excellent control of all the types of fleas infesting poultry.
3. If rapid control is desired apply 2% carbolic ointment to the masses of attached fleas. Care should be taken to keep the ointment away from the eyes of the birds.

(3) **Fowl Ticks**

The fowl tick is a pernicious parasite found throughout the country excepting the south. The tick is nocturnal in its habit and can live without feeding for nearly three years. It is comparatively more active and abundant during the springs and summer months. Fowl tick is also known as 'blue bug', 'ebode tick' and 'topman'.

Damage and symptoms : They feed at night for about an hour on the host and then retire after each feed into the crevices. They suck the blood and cause anaemia in birds besides transmitting tick fever to them. Severe infestation can cause mortality of birds due to loss of blood and irritation. The feathers become dull, ragged and egg production is reduced or stopped.

Control : Ticks are more difficult to control than other ectoparasites. For good control the following measures can be adopted :

1. Apply with extreme thoroughness, if possible under high pressure, 3% malathion spray to the hen houses particularly the crevices. Birds should be kept away during spraying.
2. Spray 0.5% solution of lindane or toxaphene or chlordane to the roosting trees or out buildings infested with ticks.
3. Walls, ceilings, roosts and nests should be wetted thoroughly with an acaricide spray at 2.25 litre per 1,000 sq. feet.
4. Houses made of wood and brick should be sprayed or washed with the following emulsion after thorough cleaning

   Soap—1 part
   Kerosene oil—3 parts
   Phenyl—3 parts
   Hot water—93 parts

   This emulsion should be used while hot.
5. Painting or spraying walls and roosts with anthracine oil (Carbolineum) is a good and effective remedy.

   If this oil is used, poultry should be excluded from the housing until the oil has dried into the wood, because it results in 'Off odors' in the eggs of the birds.

(4) **Poultry Mites**

Mites attacking poultry are generally small in size and have four pairs of legs as against the three pairs possessed by the lice. Three different species of poultry mites are commonly found in India. These are red-mites, scaly-leg mites and depluming mites. They live in cracks near about the roosts, floors, walls or ceiling of the hen houses during the day time. They remain inactive during winters and become active with the advent of spring.

Damage and symptoms : Mites come out in the night when the fowls are resting and suck their

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Role Of Microorganisms In Soil Fertility And Plant Nutrition

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The character of soil as a living body may be attributed to the presence of diversified groups of microorganisms in it. The importance of microorganisms in soil can be elucidated from the fact that they carry out numerous biochemical processes of vital importance, including those involved in the transformations of nitrogen in soils, especially, the processes of ammonification, nitrification and nitrogen fixation. These processes bring about the liberation of nitrogen, in an available form, from complex organic nitrogenous substances. The oxidation of ammonia to nitrate and the fixation of atmospheric nitrogen by microorganisms in soils is of paramount importance. (Nitrosomonas spp. and Nitrobacter spp. for nitrification, and Rhizobium and Azotobacter for fixation of atmospheric nitrogen, respectively).

In the process of life activity of microorganisms, numerous bio-chemical processes are brought about in soil which are of considerable importonce in plant nutrition. Soil microorganisms transform enormous mass of organomineral debris and continuously liberate/synthesize new substances. These microbes (Bact. fungi, actinomycetes and algae) in soil excrete varied types of active biocatalysts, metabolities, enzymes or organomineral debris, which ultimately helps in improvement of physical conditions of soil. The microbial enzymes are very reactive and their power of bringing about micro bial changes is tremendous. For instance, one molecule of catalase originating from micrococcus lysodelacal is capable of decomposing 19 million molecules of hydrogen peroxide in one minute (Alexander, 1961).

Microorganisms play unique role in weathering of rocks and minerals, enrichment of soil in plant nutrients and maintenance of soil fertility. For example, the autochthonous microorganisms are capable of thriving on carbanaceous material for their energy, transform organic nitrogen, phosphorus, sulphur and iron compounds in the simple inorganic compounds which are utilized by higher plants. Sulphur is oxidised through S-oxidizers (Thiobacillus spp.) iron through iron oxidizers (Ferrobocillus spp.) phosphorus through phosphobacterin and nitrogen through Nitrosomonas spp. and Nitrobacter spp. (Waksman, 1957).

Soil microorganisms, probably, have more amazing powers to survive under the adverse and varying temperature conditions than other form of life on the earth. The life activity of some of them ceases at temperature above 10°C (Psychrophiles) whereas, certain heat loving groups (Thermophiles) produce decay in compost heaps even at temperatures above 70°C (e.g., ciostridium thermocellum). Another group of microorganisms, lichens, fungi, actinomycetes alongwith green algae, colonise on the bare surface of rocks and weaken the rock constituents (Glazovskaya, 1950), whereas a net work of fungal hyphae result in the formation of stable aggregates ultimately helping to increase the yield of crops. Hubbel and Staten (1951), observed that bacteria create the least relative amount of large soil aggregates, whereas actinonycetes are 17 times more efficient than bacteria, fungi are the best of all for this purpose. The humic acid and certain polysacharides excreted by micro-organisms also improve the physical conditions of the soil.

All microorganisms produce two types of enzymes, viz., extracellular and intracellular. The extra-cellular enzymes bring about hydrolytic eleavages of complex molecules of proteins, cellulose, hemicellulose, lignin, fats and waxes etc. Hence

hydrolyses in soil can be called as digestive juices of soil. Other groups of enzymes (intracellular enzymes) carry out synthesis of proteins, carbohydrates etc. within the cell through endothermic reactions (e.g., oxidase and dehydrogenase).

Microorganisms work in an intricate, but coordinated way, which can be had from an instance from cleavage of protein molecule, which are essentially mosaic of amino-acids, linked together by peptide bonds. Proteases or proteolytic enzymes (extracellular enzymes) cleave/brack down the protein molecules either at terminal ends (e.g., expopetidases) or at the middle of the molecule (e.g., endopeptidases). The sequence of the change is proteins—proteoses—peptones—peptides—amino-acids. Aminoacids, so liberated are either consumed by soil microorganisms or plants or deaminized and decarbohylated resulting in the formation of ammonia (Waksman, 1957). The formation of ammonia in soil is one of the most vital biological processes-nitrification through participation of aerobic Nitrosomonas spp. and nitrobacter spp. and The process results in the change of NH_3-N via No_2—N to No_3-N and since crop plants normally utilize NH-N or NO_3-N, the above microbial activity in soil is solely responsible for nitrogen nutrition of plants.

Unlike above process, moment soil moisture level rises more than 60 per cent of their water holding capacity, a host of denitrifying bacteria (e.g., Micrococcus denitrificans, Pseudomonas denitrificans etc.) reduce the nitrate nitrogen into elemental/gaseous (N—N) nitrogen, which is normally of no use to plants and is lost into the atmosphere.

Both symbiotic and non-symbiotic microorganisms (e.g., Rhizobia, aerobic, Azotobacter spp. and anaerobic clostridium spp., respectively) and blue green algae are responsible to a great extent for recuperation of nitrogen reserves in the soil. As high as 250 kg of nitrogen per hectare has been reported to be fixed by Rhizobium in association with grass clover. Biological fixation of nitrogen is more efficient and cheaper incomparison to that of industrial process which consumes lot of energy And in these days of energy crisis we should, therefore, domesticate and prepetuate such useful soil microorganisms in our soils in order to economise the use of chemical fertilizers whose, prices have gone very high. "Azotobacterin", "Phosphabacterian" and "Nitragin" are some of the microbial fertilizers which if used properly, may result in efficient crop production and minimization of losses of chemical fertilizers.

It has been confirmed that blue green algae also enriches soil with nitrogen and thus results in an increase in yield of rice. The addition of sulphur to alkali soils is beneficial only because of the activity of the sulphur acidifying bacteria, which produce H_2SO_4. The latter neutralize the alkalinity (Richard, 1954). The reaction has been predicted to be as follows :

$2S+2O_2=2SO_3$ (Microbiological oxidation) (i)

$SO_3+H_2O+H_2SO_4$ (ii)

$H_2SO_4+CaCO_3=CaSO_4+CO_2+H_2O$ or (iii)

$H_2SO_4+2CaCO_3=CaSO_4+Ca(HCO_3)_2$

$2\ Nax.+CaSO_4=CaX_2+Na_2SO_4$ (iv)

Where X is the soil exchange complex.

These microorganisms also transform sulphur of sulphur containing aminoacids to hydrogen sulphide under anaerobic conditions, while certain fungi under aerobic conditions carry out the sulphate as the ultimate produce of sulphur and plants use sulphur in the forms of SO_4 more efficiently. The organic acids and carbondioxide that are released by microbial decomposition render insoluble phosphate and other unavailable compounds more available to plants. There are reports that sulphur bacteria, purple bacteria, and blue green algae, in water-logged paddy soils, are responsible for N-fixation which is expected to be accelerated due to the presence of light.

Thus from forgoing discussion it may be concludcd that if the soils were deprived of microbial population then (i) the limited store of life giving nitrogenous compounds of soils would be exhausted (ii) some of the plant nutrient like, P,S, Mn, Fe, Ca, K etc., would be put out of circulation and become unavailable to plants. (iii). The break down/degradation of the complex substances of mineral and organic origin into simpler products/forms, which constitute the interminable source of life on the planet would be stopped and thus it shall result in the covering of entire earth surface with dead mass or debris. And infact, all the life on the earth would be doomed to extinction. Finally, it can be concluded that the very character of the normal soil to support plant, animal or microbial population may be attributed to the *presence in it of a slow stream of nutrients and microorganisms in soil bring about numerous biochemical processes, which in turn keep this slow stream of nutrients everflowing.*

(*Contd. from page 10*)

Calcium

Calcium is absorbed as calcium ion. A deficiency of calcium manifests itself in the failure of terminal bud to develop. The same applies to the apical tips of the root, as a result plant growth ceases.

Specific physiological functions performed by calcium are not clearly understood. It is a structural element and is present in the middle lamela as calcium pectate. It is immobile and its deficiency symptoms first appear on the young growing parts. Calcium is related to protein synthesis by its enhancement of the uptake of nitrate nitrogen. Being a part of the cell wall it gives strength to the straw of grain crops. It is also helpful in the development of root and seed formation.

Generally, supply of calcium in most of the soils is adequate and artificial fertilization with calcium is not required.

Magnesium

Magnesium is absorbed in the form of Magnesium ion. It is a constituent of chlorophyll molecule. The importance of Magnesium is, therefore, obvious because without chlorophyll green plant would fail to carry on photosynthesis.

Magnesium appears to be related to phosphorus metabolism and is considered specific in the activation of a number of plant enzymes. Magnesium is also related to the synthesis of oil. With sulphur it brings about significant increase in the oil content of several crops.

Magnesium is an immobile element and thus is not easily translocated from older to younger plant parts. Consequently the symptoms of magnesium deficiency appear on younger leaves. One of the characteristics symptoms is interveinal chlorosis of the leaves in which only the veins remain green. General yellowing similar to nitrogen deficiency may also be produced.

Magnesium fertilization is generally not needed as the soils contain adequate supplies.

Sulphur

Sulphur is absorbed by plant roots exclusively as sulphur ions. A deficiency of sulphur has a pronounced retarding effect on plant growth and results in uniformly chlorotic plants stunted, thin stemmed and spindly. These symptoms resemble those of nitrogen but unlike nitrogen, sulphur is not easily translocated.

Among its specific functions may be mentioned synthesis of sulphur containing amino acids such as systeine, systein, methionine. It is present in oils of plants of mustard and onion families.

Sulphur fertilization would be essential with increasing use of high analysis fertilizers and high intensity crop rotations. Significant increases of yield and oil content of several crop have been obtained.

Micronutrients

Boron : It is absorbed as borate ion. It is required in small quantities for plants of bean families and also for brassicas. Boron is not readily translocated and the first visual symptoms of deficiency appear as cessation of growth of terminal bud followed by death of young leaves. Several root crops are affected by deficiency of boron in which the characteristic symptom is brown or black heart.

The primary role of boron appears to be concerned with the uptake of calcium by roots and with its efficient use in the plant.

The deficiency of boron can be prevented by the application of sodium borate or borax both as soil application or through foliage. In certain saline alkaline soils the injurious effects are due to the presence of toxic amounts of boron.

Iron : Iron is absorbed mostly as Ferrous ion. It has a low availability in calcareous or alkaline soils and in acid soils containing high phosphate levels. Soybeans sorghums and vegetable crops iron exhibit deficiency.

Iron is less mobile and the deficiency appears first on young leaves. Intraveinal chlorosis and in severe cases completely white leaves is characteristic of iron deficiency.

It functions as activator of several enzymes systems. It also helps chlorophyll synthesis. Iron has been shown to be capable of partly replacing molybdenum. Its deficiency can be removed by soil application of Iron chelate or by foliar sprays of ferrous sulphate.

Manganese:

It is absorbed as Manganese ion. Like iron it is also relatively immobile. Deficiency symptoms appear first in the younger leaves. Interveinal

chlorosis in which lateral veins stand prominently green is its characteristic symptoms.

It functions as an activator of numerous enzymes concerned with carbohydrate metabolism. Manganese is required by plants in small quantities. Large quantities are toxic. Its deficiency can be corrected by application of foliar sprays of manganese sulphate.

Copper: Copper is absorbed by plants as cupric ion. Symptoms of deficiency vary with the crop. In corn youngest leaves become yellow and stunted and as the deficiency become more severe the older leaves die back. In advance stages dead tissue appears along the tips and edges of the leaves similar to potassium deficiency.

It is an activator of several enzymes. Its deficiency can be corrected by the application of copper sulphate either through soil or through foliage.

Zinc—Zinc is absorbed by plant as Zinc ion. It is the one micronutrient which is generally deficient in our soils. Symptoms of zinc deficiency have been observed in corn, sorghum, paddy, legumes, wheat, cotton and fruit trees.

Zinc functions in plants largely as metal activator of enzymes.

Molybdenum:

Molybdenum is absorbed by plant roots as molybdate ion. It has special importance for such crops as alfa alfa, grasses, tomatoes, sweet potatoes, soybean, and vegetables including cauliflowers. Molybdenum is known to be specific for the activation of enzyme Nitrate reductase and Zanthin oxidase. It is required by the Rhizobia for nitrogen fixation. It is also required by non legumes for nitrate reduction.

Chlorine: The exact role of chlorine in plant nutrition is not definitely known. It is thought to be essential for the photosynthetic process.

(*Contd. form page 12*)

on very bright, thin leaf. The spots enlarge to about 6 mm in diameter whilst retaining their circular shape, and may then be surrounded by a narrow border of bright yellow tissue (due to toxin) especially if the affected leaf is of a deep-green colour. Later the spots enlarge to an irregular shape or may retain their circular form. At this stage there generally appear concentric rings or zonations in the dead tissue, and a broad ring of bright yellow round the spot. Under epidemic conditions large areas of tissue or even the whole leaf, may go brown and be destroyed. Minute dark brown dots containing conidia and conidiophores can be seen on the spots. The disease is also found as minute dark brown or, black spots on the stems, midribs, flower stalks and capsules of plants. Brown spot can also be destructive in the barns.

Mode of spread: The disease starts on the bottom leaves as they approach senescence, and then moves upwards. The most obvious condition which favours the disease is high atmospheric humidity with frequent rains. The disease starts from the spores in the infected plant debris. The secondary spread is by airborne condia.

Control measures: Adequate control measures are not yet available. Prevention by using seed treated with silver nitrate, field hygiene and growing soundy fertilized crops on suitable soils is important. Spraying with copper fungicide starting at the first sign of infection will be useful in controlling the disease.

6. **Mosaic**

Mosaic of tobacco is caused by tobacco mosaic virus. This disease is very common in all tobacco growing areas causing enormous loss.

Symptoms: Plants at all stages are attacked. The disease is characterised by the appearance of light and dark green areas on the leaves. Blistering and malformation of leaves are frequently seen. Sometimes necrotic brown spots or scorched patches may appear on leaves which may be much reduced in size. The growth of the infected plant is retarded. In severe infections the leaves are narrowed, puckered, thin and malformed. Partial sterility of infected plants may also be observed. The affected leaves get burnt during curing process.

Mode of spread: The virus is sap transmissible and enters the host through wounds. Insect vector is not known. It has a wide host-range, affecting nearing 50 plant species belonging to 9 families. The virus is transmitted through freshly extracted tomato seeds but not through tobacco plants. The virus is easily transmitted by mechanical means (sap) and by wind and water in the field. Cultural practices like topping or clipping cause wounds on the plant which become the portals of virus entry. Thus it helps in the spread of the disease from diseased to healthy plants. The virus is carried easily in cirgarettes, pipe, tobacco, implements and workers.

Control measures: As the virus is highly infectious, crop sanitation is very important. All infected plant debris should be burnt. Wider spacing must be adopted to prevent leaf contact between plants. Infected plants should be rogued and destroyed both in the nursery and in the main field. All the solanaceous weeds susceptible to the virus should be destroyed. After handling tobacco plants, hands should be washed with soap before touching the other tobacco plants. Use of tabacco products like cigarettes, snuffs etc., by the workers in the field should be avoided.

7. Leaf curl

Leaf curl is caused by tobacco leaf curl virus. The virus is widespread in India.

Symptoms: The disease usually appears in the field 4-6 weeks after transplanting. The disease is generally seen on transplanted crop in October-November. The disease causes dwarfing of the plant and reduction in leaf size, curling of the whole or portion of the leaf blade, thickening and greening of veins. Usually the thickened leaf blade exhibits vein-clearing symptoms. Enation and leaf-like outgrowths along the veins are also common. The inflorescence is greatly condensed and veins of the calyx green and thickened.

Mode of spread: The virus is not transmitted by sap inoculation or seeds but it is transmitted by the white-fly, *Bemisia tabaci*. The virus infects tomato, *Petunia* and other solanaceous host plants.

Control measures: Removal and destruction of all solanaceous and other weed hosts is necessary to reduce the source of inoculum. Roguing of diseased plants in early stage is helpful. Application of superphosphate appears to increase the resistance of tobacco. The plants must be sprayed regularly to control the white-fly vector, starting in the nursery and continuing in the field, at 10-15 days intervals.

8. Angular leaf spot

The disease is caused by the bacterium, *Pseudomonas angulata*.

Symptoms: The disease occurs at any stage of plant growth including nursery seedlings. On seedlings the first signs of the disease usually are several angular, dark-coloured spots on a single leaf. These spots are generally much smaller than those on mature plants and have a narrow, translucent margin. On plants in the field the spots are characteristically angular and vary in size. As the disease advances the spots enlarge surrounded by chlorotic yellow haloes. Spots on dark tobacco are large and zonate. With age the centers may turn nearly white. Several spots may coalesce involving larger areas of the leaf.

Mode of spread : The plant debris probably harbours the bacteria responsible for primary infection. The bacteria spread in the field by wind and splashing rains. Longer period of rainy weather with driving winds greatly favour the disease spread.

Control measures : Control measures for this disease largely centre around the problem of obtaining healthy seedlings. Seed pods showing no sign of infection should always be selected for seed. Old tobacco refuse should not be used on seed beds.

9. Broom rape or Orobanche

Broom rape is a phenerogamic parasite on tobacco. This is a root parasite. Both indigenous and virginia tobacco suffer losses ranging from 5 to 85% due to this parasite.

Symptoms : It appears singly or in clusters (up to 50 plants) around a few tobacco plants in a field. The affected plants are usually found in patches. Parasite seeds germinate when they come in contact with tobacco roots and form tubercles from the roots from which haustoria are formed. Below the soil, the parasitic shoots are found attached to tobacco plants and derive nourishment from them. Usually the parasite plant develops 5 to 6 weeks after planting the tobacco. The parasite develops succulent yellow-coloured shoots (15-30 cm height) with tiny scale-like purple or blue flowers. The pods are dark brown and each produces hundreds of small seeds. The seeds shed in the soil and become viable for 2 to 3 years and germinate only when they come in contact with tobacco root. The affected tobacco plants are stunted and yellowish. Yield of affected plant is reduced considerably. Usually ratoon crop and tobacco raised during summer are not affected. In the irrigated crop it appears during January-Februry.

Mode of spread : The seeds of this phanerogamic parasite which shed in the soil remain viable for 2 to 3 years and germinate in contact with the tobacco roots and infect the tobacco plants. The parasite can also infect tomato, brinjal, datura, sunflower, *Solanum xanthocarpum* and other solanaceous hosts.

Control measures : A three year rotation of crops including chilli may be followed. Chilli is immune to infection but it will induce the germination of parasitic seeds. The parasite can be eradicated by hand picking of the parasitic plants before flowering and seed formation. The collected parasitic plants should be burnt and destroyed in far off places. Spraying the soil with 25% copper sulphate solution has been reported to be useful in destroying the parasite.

(*Contd. from page 17*)

in traditional *moong* growing areas the use of efficient strains of this culture brings about increase in yield. This culture can be obtained from any Agricultural Research Institute or Agricultural University in the country at nominal price. The instructions for using this culture are printed on the cover of the packet.

Sowing method

Soon after preparing the field the sowing should be carried out, otherwise lack of moisture will result in poor germination. Sowing should be done either with the seed drill or behind the plough in the rows at a distance of 30 cm from each other. As the growth of the plants is arrested during summer season spacing wider than 30 cm would result in poor stand and consequently the low yield. After sowing the furrows should be covered with soil by planking. Twenty kilogram seed would be required for sowing in one hectare of land. The seed treated with rhizobium culture should not be exposed to hot sun light. Sowing should be done either in the morning hours or in the afternoon.

Irrigations

Irrigation is the most important input for summer *moong*. First irrigation should be given 20-25 days after sowing. In the loam and heavy soils and normal weather two more irrigations would be necessary at an interval of 15 days. However, in in the light soils or during exceptionally hot weather three irrigations at an interval of 10 days are required after the first irrigation.

Weeding

As compared to *kharif* season, weeds are less serious during summer. However, they bring loss to the crop during this season as well. One manual weeding, preferably after the first irrigation, is enough. At this stage the thinning of the plants in the dense rows can be carried out simultaneously. Where labour is a problem, weeds can be checked economically by chemicals. Lesso @ 2.0 kg a.i./ha and Promotryne @ 1.0 kg a.i./ha can be used successfully after sowing but before the germination.

Protection from diseases and insect pests

Among the diseases yellow mosaic is most serious. Jassids, beetles, white flies and borers bring heavy damage to the crop at different stages of growth. Single soil application of systema.ic insectidies, namely 5% disulfoton at the rate of 25-30 kg/ha. protects the crop from these pests for about 4-6 weeks. This insecticide also minimizes the incidence of yellow mosaic disease. The treated crop should not be fed to the cattle as a green fodder on account of residual toxicity of the insecticide. The cost of this chemical may fluctuate from Rs. 250-300/ha., but the benefit accrued by controlling the pest complex in achieving the yield potential is economical as only one to two quintals increase in yield would meet its cost. In practice the increase in yield with the use of this insecticide is of the order of 5 to 6 quintals/ha. The initial cost of this insecticide appears to be prohibitive as compared to other insecticides, but its soil application would save frequent foliar application which may be necessary to protect the crop with other chemicals and may not be as efficient.

In case the soil application is not given spraying the crop with 0.07% endasulfan or 0.1% lindane or 0.05% monocrotophos at an interval of 15 days may be necessary.

Harvesting

After 50-55 days of sowing, the pods start maturing. Since the fruiting and maturity are not synchronous and the pods shatter after drying 2-3 pickings are required. In variety PS 7 the maturity is quite uniform and the pods also do not shatter, the picking can be carried out at one time or the crop can be harvested like other crops. After complete picking of the pods the plants should be turned down in the soil. This will add to the organic matter in the soil.

Yield

The pods can be threshed easily after drying. With the use of improved varieties and recommended package of practices the yield of about 8-10 quintals per hectare can be easily obtained during summer season. The yield can be considered to be low as compared to major *rabi* and *kharif* crops, but when the short duration of 60-70 days of the crop and utilisation of land between two seasons is taken into consideration this yield is quite significant. Besides obtaining a good yield the fertility of the soil is improved and therefore, the succeeding crop is benefitted. Considering these facts raising of *moong* during the summer season is quite a profitable proposition.

(*Contd. from page 16*)

(iv) Construction and equipping seed storage.

(v) Seed packaging, shipping and transport.

(vi) Quality control in storage.

The overall interests of Indian agriculture would be well looked after if due care is given to proper organisation of a sound seed industry. Proper care should start from selection of crops, purity of varieties, quality checks at all stages of seed production, processing storage and distribution and overall adequate arrangements for making these high quality seeds available to the farmers in the remote villages. As soon as the necessary tempo is created to build-up a sound seed industry capable of meeting full effective demand of the farmers, the country would be ushering into era of prosperity and plenty.

(*Contd. from page 18*)

40.8 Q grain/ha by corresponding triticale lines.

Economical in Water use : Many triticale lines are covered with white waxy powder. This helps in reducing the loss of water from plant surface by reflecting back some of the solar radiation and also acting as barrier in vapour diffusion. Such characters of crop plants are desirable in *barani* areas as the limited soil moisture could be used efficiently for long period.

Large spike conducive for higher yield : It is general belief that large spikes of *rabi* cereals which contribute substantially for development of bold grains are quite useful in dryland areas. In the later phase of crop growth when lower leaves dry and wither due to high temperature and scarce soil moisture, the green spikes play pivotal role to manufacture food material which is directly utilized by developing grains. Triticale possesses larger spikes than wheat or barley, hence better for *barani* areas.

(*Contd. from page 22*)

blood through their sharp mouth parts. They remain hidden in day time, in their resting places. The mites produce marked weakening and even death in heavily infested birds. The fluffy feathers around the tail become ragged, matted with masses of mite eggs and faces as well as scabs of skin. The fowls become drooping, pale about the head and they stop egg laying. Sitting hens and chicks often die.

Prevention and control: Their prevention and control is comparatively easy and the following measures are recommended.

1. The poultry house should be thoroughly cleaned. It should then be treated with 1% malathion spray at the rate of 5 to 10 litres per 1000 sq. feet or 5% malathion dust at the rate of 0.5 kg per 40 sq. feet of litres. Otherwise sulphur dust can be applied at 2 kg per 100 sq. feet of floor space which will give excellent control.

2. The birds should be treated with 0.5% malathion solution using about 5 litres per 100 birds or by dusting with 1% malathion dust at the rate of 0.5 kg per 100 birds.

3. The roosts should be painted with 40% nicotine sulphate or 3% malathion solution in oil at 100 ml per 150 linear feet.

The spread of diseases, pests and other infestations can be checked by taking the following simple precautions :

1. Poultry house should be constructed in such a way so that they may be airy, free from cracks and crevices etc., which provides shelter to the pests.

2. Houses should be thoroughly cleaned and treated with a suitable chemical before introducing the birds.

3. New birds should be treated with suitable chemicals before they are introduced in the flocks.

4. Special care should be taken that neither the workmen nor their equipment carry any contamination of the pests.

5. Wild birds should not be allowed to make nests around or inside poultry buildings as they may act as carriers of infestations to the poultry.

6. The birds should be kept in isolation for some time in order to free the flock from temporary parasites. Thus, a ten day holding of birds infested with fowl tick larvae will free the birds from these pests. The holding crates should be treated with suitable chemicals or hot water after the isolated birds have been removed from them.

सरसों के एफिड़ों की रोकथाम

दानेदार कीटनाशक दवाएं ज्यादा अच्छी

लुधियाना स्थित पंजाब कृषि विश्वविद्यालय में तरल और दानेदार कीटनाशक दवाओं से सरसों के एफिडों की रोकथाम के परीक्षण किये गये। इनमें दानेदार कीटनाशक दवाओं के इस्तेमाल से परिणाम अच्छे मिले।

दानेदार कीटनाशक दवा डाली गयी फसल से प्रति एकड़ ४५० किलो पैदावार मिली और घोल छिड़की गयी फसल से ३०० किलो। दवा डालने में ७५ रुपये लागत आई।

फसल में प्रति एकड़ ४ किलो थिमेट १० जी (फोरेट) या ८ किलो डाइसिस्टान सालविरैक्स ५ जी (डाइसल्फोटान) डालने की जरूरत पड़ती है। दानेदार दवा छिटक कर डालनी चाहिए और उसके बाद हल्की सिंचाई कर देनी चाहिए। थिमेट दवा का इस्तेमाल नंगे हाथ कभी न करे। परीक्षणों से इस बात की भी पुष्टि हुई है कि एफिड़ों की रोकथाम में दवा का छिड़काव भी प्रभावी रहता है। छिड़काव के लिये इसे उपयुक्त सायफंग, मैटासिस्टाक्स, रोगर, डिमेक्रान और मैलाथिआन दवायें उपयुक्त हैं।

धान का तना छेदक

प्रभावी रोकथाम सम्भव

विशेषज्ञों का सुझाव है कि धान के खेतों में से तना छेदक नष्ट करने के लिए धान के ठूठों को पूरी तरह निकाल कर उन्हें जला दें।

धान की अकेली फसल उगाने पर तना छेदक आमतौर पर बाल निकलने की अवस्था में लगता है। इससे बाल सफेद हो जाती हैं और दाने भरते नहीं। इसके कारण नुकसान ५ से ७० प्रतिशत के बीच होता है। दक्षिण में यह फसल में पत्ती निकलने का अवस्था में लगता है जिससे पौधों की शोभ सूख जाती है।

तना छेदक की प्रभावी रोकथाम के लिये कार्बोफूरान. कार्बेराइल लिंडेन, मैफास्फोलन, क्विनलफास या क्लोरफेविनफास जैसी दानेदार १ किलो तेज दवा खड़े पानी में डालें।

पत्तियों पर एन्ड्रिन या इथारल-पैराथियान के दो छिड़काव से भी इस कीड़े की रोकथाम काफी हद तक हो सकती है।

इस भयंकर कीड़े को फैलने से रोकने के लिये कीड़े लगी फसल को काटने के बाद उसके ठूठों की जड़ सहित उखाड़ना अत्यन्त आवश्यक है।

शहतूत की पत्तियों का दोहरा प्रयोग

रेशम के कीड़े जब शहतूत की सारी पत्तियाँ खा जाते हैं तब उनके डंठल बच जाते हैं। उन डंठलों से पशुओं का पौष्टिक चारा बनता है। अनुसंधानों से पता लगा है कि शहतूत की पत्तियों के डंठल प्रोटीनयुक्त हरे चारे की ही भांति पौष्टिक होते हैं।

राष्ट्रीय डेयरी अनुसंधान संस्थान बंगलौर में किये गये परीक्षणों से पता चला है कि ३५० किलो वजन की गाय को ८ किलो शहतूत की पत्तियों के डंठल में ४ किलो रागी का भूसा मिला कर खिलाना उनके शरीरिक पोषण के लिये पर्याप्त रहता है।

कपास की नयी किस्म

तमिलनाडु कृषि विश्वविद्यालय ने हाल में ही कपास की सीबीएस—१५६ नामक लम्बे रेशे वाली एक निराली किस्म निकाली है। यह किस्म कपास की प्रचलित एच-४ और वारालक्ष्मी किस्मों से ज्यादा अच्छी है।

यह बताया गया है कि इस किस्म की फसल से प्रति एकड़ ४ क्विन्टल अतिरिक्त कपास मिलती है।

इस किस्म का रेशा लम्बा तथा बढ़िया होता है और रेशे की लम्बाई ३६ सेन्टीमीटर होती है। कपास की एच-४ किस्म से ५० नम्बर, वारालक्ष्मी से ६० नं० एम० सी वी-४ से ७० नं० सुजाता से ९० नं० का सूत तैयार किया जाता है जबकि इनकी तुलना में सीबीएस-१५६ से मिश्र से आयात की गयी बढ़िया किस्म के बराबर १२० नं० का सूत तैयार किया जाता है। इसकी रुई भी सुन्दर तथा मजबूत होती है।

इसकी फसल १७० दिन में पक कर तैयार हो जाती है। यह तना घुन रोधी है और कुछ-कुछ उकठा रोधी भी है।

किसानों को सीबीएस-१५६ से प्रति एकड़ १५ क्विन्टल कपास की पैदावर मिली जिससे उन्हें १२,००० रुपये का अधिकतम लाभ हुआ। इसकी फसल से प्रति एकड़ औसत लाभ ७,५०० रुपये तक मिल सकता है।

मुर्गी के चुग्गे में प्रोटीन

सूरज मुखी का आहार ज्यादा अच्छा

पंतनगर विश्विद्यालय के वैज्ञानिकों का कहना है कि मुर्गी के चुग्गे में से मूगफली की खली का कुछ भाग निकाल कर उसकी जगह सूरज मुखी का आहार मिलाना फायदेमंद रहता है।

विश्वविद्यालय में किये गये अध्ययनों से पता लगा है कि छिलका उतारे बीज से तैयार किया सूरज मुखी आहार खिलाने से मुर्गियों का वजन बड़ी तेजी से बढ़ता है। मुर्गियों ने सूरज मुखी आहार को ज्यादा पसन्द किया और उसे उन्होंने बड़े चाव से खाया।

लेकिन परीक्षणों में यह भी पाया गया है कि चुग्गे में प्रोटीन पूरक के रूप में मूंगफली की खली की जगह सूरज मुखी आहार को २५ प्रतिशत से ज्यादा मिलाना फायदेमंद नहीं।

बारानी क्षेत्रों में जल संरक्षण से अधिक उपज

डा० राम सूरत सिंह एवं राम किशुन सिंह
चन्द्रशेखर आजाद कृषि एवं प्रौद्योगिक विश्वविद्यालय
कानपुर-२

उत्पादन के अन्य सभी साधन मौजूद होते हुए भी वर्षा की अनिश्चिता या अपर्याप्यता के कारण प्राय: फसलें असफल हो जाती है क्योंकि फसलों की सफल वृद्धि एवं लाभदायक उत्पादन के लिए जल का पर्याप्त मात्रा में प्राप्त होना अत्यन्त आवश्यक है। हमारे देश में अत्यन्त अल्प मात्रा में वर्षा वाले (१ इंच या इससे कम) तथा सिंचाई की सुविधाओं के अभावग्रस्त क्षेत्र लगभग ४७० लाख हैक्टेयर है जो कि अन्तर्गत सम्पूर्ण क्षेत्रफल का लगभग ३६ प्रतिशत है। इस प्रकार के क्षेत्र आंध्र प्रदेश, गुजरात, राजस्थान, पंजाब, हरियाणा, महाराष्ट्र, मध्य प्रदेश, तामिलनाडु तथा जम्मू एवं काश्मीर राज्यों में पाये जाते हैं। कुल मिलाकर देश के ८४ जिले इस प्रकार की समस्या से ग्रस्त हैं। देश को समृद्ध बनाने के लिए इस प्रकार के सूखे क्षेत्रों में विशेष प्रकार की कृषि क्रियाएं अपनाई जानी चाहिए तभी अधिकतम एवं अधिक उत्पादन सम्भव है। वर्षा से प्राप्त जल का भूमि में अधिकतम मात्रा में संचय करना तथा उसे सुरक्षित रखकर फसलों के उपयोग में लाना इन क्षेत्रों में खेती की मुख्य समस्या है। अत: इन क्षेत्रों में ऐसी कृषि क्रियायें अपनाई जानी चाहिए जिससे वर्षा के जल की अधिकतम मात्रा का भूमि में संचय हो सके तथा वर्षा ऋतु के पश्चात् उस जल की हानि को न्यूनतम् करके पौधों के लिए समुचित रूप से उपयोग में लाया जा सके।

भूमि में वर्षा से प्राप्त जल के संचय को बढ़ाने के लिए यह अत्यन्त आवश्यक है कि भूमि में जल का अधिक से अधिक शोषण हो तथा भूक्षरण और अपधाव इत्यादि द्वारा न्यूनतम हानि हो। भूमि में वर्षा जल के शोषण को निम्नलिखित विधियों द्वारा बढ़ाया जा सकता है।

(१) अभेद्य पर्तों की तोड़ना

काफी लम्बे समय तक दशीहल द्वारा एक ही गहराई पर जुताई करते रहने से भूमि में एक कड़ी तह बन जाती है। कम वर्षा वाले क्षेत्रों में यह कठोर पर्त अपेक्षाकृत और जल्दी बन जाती है। यह कड़ी पर्त वर्षा जल के भूमि में शोषण क्रिया में बाधा पहुंचाती है। फलस्वरूप मृदा की जल शोषण क्षमता घट जाती है। इतना ही नहीं ये पर्तें जड़ों के प्रवेश को भी रोकती हैं। अत: इन कड़ी पर्तों को तोड़कर जलवेध्यता में वृद्धि की जा सकती है तथा जड़ों के विकास को भी बढ़ाया जा सकता है। यह क्रिया वर्षा प्रारम्भ होने के पूर्व गहरी जुताई करने वाले यंत्रों की सहायता से की जा सकती है। अधोमृदा कर्षक तथा रूखानीदार हल इसके लिए अति उत्तम सिद्ध होते हैं। इनमें ३०-४० से० मी० की दूरी पर कई फाल लगे होते हैं जो कि भूमि में ६० से० मी० तक गहरी जुताई कर सकते हैं। अभेद्य पर्त तोड़ने का कार्य उस समय करना चाहिए जबकि मृदा में नमी काफी कम हो। ऐसे समय में अधोमृदा कर्षक चलाने से अभेद्य पर्त टूटकर बिखर जायेगी और भूमि सरन्ध्र हो जायेगी।

(२) मेड़ एवं जालियां तथा खाइयां एवं बंध बनाना

वर्षा का जल किसी स्थान पर जितने अधिक समय तक भूमि के सम्पर्क में रहेगा उतना ही अधिक उसका शोषण भी होगा। कम ढाल या समतल भूमि पर १०-१५ मीटर की दूरी पर जालियां व मैड़ें बना देने से वर्षा का जल खेत में अधिक समय तक रुकता है तथा उसकी लगभग सम्पूर्ण मात्रा भूमि में शोषित हो जाती है।

अधिक ढालदार भूमि में जल को रोक रखने के लिए खाइयां तथा बंध बनाये जा सकते हैं। क्रमबद्ध बंध तथा समतल बंध जल को रोक रखने तथा शोषण बढ़ाने में अत्यन्त उपयोगी सिद्ध होते हैं।

ढाल के आर-पार की कई जुताई तथा कृषि क्रियायें जल के बहाव में व्यवधान उपस्थित करती है जिसके फलस्वरूप जल अधिक समय तक भूमि तल पर रुका रहता है और उसका शोषण भी अधिक होता है।

(३) छाद्या वरण (Mulching)

भूसे या धासफूस इत्यादि को भूमि की ऊपरी सतह पर फैला देने से भी जल शोषण में वृद्धि होती है। घास फूस से ढकी भूमि पर वर्षा के बूंदों का सीधा प्रहार नहीं होने पाता है जिससे कि ऊपरी मृदा की संरचना सुरक्षित रहती है। साथ ही जल के बहाव में रुकावट तथा भूरक्षण में भी पर्याप्त कमी हो जाती है और जल का शोषण अपेक्षाकृत अधिक होता है।

(४) मृदा संरचना में सुधार

बारानी भूमियों की संरचना प्राय: अति सूक्ष्म तथा जलवेध्यता बहुत ही कम होती है। तेजगति से पड़ने वाली वर्षा की बड़ी-बड़ी बूदों से संरचनात्मक इकाइयाँ टूट जाती है जिसके फलस्वरूप बहुत ही बहुमूल्य मृदा बह जाती है और भूमि जल के

लिए अभेद्य हो जाती है। मृदा संरचना को जीवांश पदार्थों के प्रयोग द्वारा विकसित किया जा सकता है। जीवांश पदार्थ के सड़ने से गोंद जैसा पदार्थ उत्पन्न होता है जो कि मृदा कणों को बांधे रखने का कार्य करता है। इसके लिए यह आवश्यक है कि गहरी जुताई की जाय और पौधों की जड़ों आदि अवशेषों को भूमि में मिला दिया जाये। इस क्रिया से भूमि में जीवांश की मात्रा और जिवाणुओं की संख्या में वृद्धि होकर गोंद जैसे पदार्थ अधिक मात्रा में बनते हैं तथा भूमि में जलस्थिर मृदा इकाइयों की संख्या बढ़ जाती है। संभव हो तो रेतीली मृदा में चिकनी भूमि में रेत मिलाकर भी मृदा संरचना का सुधार किया जा सकता है।

(५) सीढ़ी दार खेती

बारानी क्षेत्रों में जहां खेत ढालू होते है वहां पर ढाल के विपरीत दिशा में मेड़े एवं नालियां कुछ निश्चित दूरी पर बनाये जाते हैं जिससे बरसात के मौसम में वर्षा का पानी बहकर खेत के बाहर अन्यत्र नहीं जाने पाता है और मिट्टी में शोषित होता रहता है। इस प्रकार से नालियों में एकत्रित नमी मेड़ों पर एवं नालियों में बोये गये पौधों को मिलती रहती है जिससे फसलोत्पादन में सहातता मिलती है। इसके अतिरिक्त बरसात के मौसम में एकत्रित नमी रबी की फसल उत्पादन में सहायक होती है।

वर्षा जल का मृदा में शोषण बढ़ाने के बाद दूसरा काम होता है कि इस प्रकार शोषित जल को किस प्रकार सुरक्षित रखा जाय कि उसका वाष्पीकरण, उत्स्वदेन एवं खरपतवार द्वारा हानि कम से कम हो और मृदा में शोषित जल का फसलों के लिए अधिकतम उपयोग हो सके। इसके लिए निम्नलिखित बातों पर ध्यान देना चाहिए।

(१) उचित कृषि यंत्रों का प्रयोग

बारानी क्षेत्रों में रबी व खरीफ की फसल के लिए खेत की तैयारी में भिन्न प्रकार के यंत्रों की आवश्यकता होती है। जुताई के यंत्र ऐसे होने चाहिए कि जिससे मिट्टी भुरभुरी हो तो जाये परन्तु पलटने न पावे। मिट्टी पलटने वाले हल तथा तवे वाले हल खरीफ की फसल से पूर्व गहरी जुताई करने तथा भूमि में फसलों के अवशेष पलटने में काफी प्रभावशाली रहते हैं। मृदा की अभेद्य पर्तों को तोड़ने के लिए अधोमृदा कर्षक, रूखानीदार हल तथा अवभूमि हलों (Subsilers) का प्रयोग किया जाता है। ये ट्रैक्टरों द्वारा चलाये जाते हैं। ये ३० से ६० से० मी० तक गहरे चल सकते हैं। खेत की तैयारी की जुताई की प्रक्रिया इस प्रकार होती है कि भूमि में समान्तर चलते हुए भूमि को काटकर भुरभुरा बनाया जाता है। और खरपतवारों की जड़ों को भी काटता जाता है।

उपरी मृदा की जुताई करने वाले यंत्र v आकार के या सीधे या मुड़े हुए धार के बने होते हैं जो कि अनुकूल ढाँचों पर लगे रहते हैं। v आकार के स्वीपस को किसी भी अनुकूल ढाचा अथवा साधारण कल्टीवेटर पर लगा सकते हैं और उसे बैलों या ट्रैक्टर द्वारा चलाया जा सकता है। बैल चालित यंत्र की २०-३० से० मी० तथा ट्रैक्टर चालित यंत्र की ५०-६० से० मी० तक गहराई होती है स्वीप का v कोण ६०-९० अंश का हो सकता है लेकिन कम कोण वाले मृदा को अच्छी तरह बखेरते हैं। यदि खेत में फसलों के अवशेष अधिक हों तो प्रत्येक फाल के आगे एक लोटन चाकू (rolling coulter) लगा सकते हैं।

बैलों द्वारा चलाये जाने वाले त्रिकोण समतल हैरो तथा कल्टीवेटर नमी संरक्षण तथा खरपतवारों को मारने के लिए अति उत्तम होते हैं एवं असिंचित क्षेत्रों में कार्य करने के लिए अति उत्तम होते हैं। बख्खर या गुत्तिका एक साधारण किन्तु अत्यन्त ही महत्वपूर्ण यंत्र है जिसे बारानी क्षेत्रों में जुताई तथा निकाई गुणाई के लिए प्रयोग करते हैं। कर्षक क्रिया स्वीपस के ही समान होती है। निकाई गुणाई के लिए फसल की पत्तियों की दूरी के अनुसार अलग-अलग आकार के ब्लेड लगाये जा सकते हैं। फल काटने वाला कोण हल की हरीस में लगाकर ठीक किया जा सकता है।

बुवाई के यंत्र ऐसे होने चाहिए जो कि बीज को ठीक से कूंडों में पहुंचा दे और पुनः उसे मिट्टी से ढंक दें। यह कार्य ऐसी सीड ड्रील से किया जा सकता है जिसके पीछे पैकिंग पहिया लगा हो। रबी के बीजों को १०-१२ से० मी० गहरायी पर बोने से नमी के सम्पर्क में आ जाते हैं। यदि गेहूं की बौनी जातियां बौनी हो तो उनको इतनी अधिक गहराई पर नहीं बोना चाहिए क्योंकि इतनी गहराई से उनके मूण उगकर भूमि के ऊपरी सतह तक नहीं आ पायेंगे।

(२) ढूंठ छाद्यावरण (Stubble mulching)

भूमि को इस प्रकार क्षोमन (Stir) कर देना जिससे फसलों के अवशेष इत्यादि सतह पर एक परत बना दें जिससे वाष्पीकरण और मृदा अपक्षरण रूक जाये और निश्यंद्य तथा नमी का संचय बढ़ जाय ढूंठ छाद्यावरण (Stubble mulching) कहलाता है। वह एक तरफा तवेदार हैरों आदि यंत्रों द्वारा बनाई जा सकती है। यंत्र ऐसा होना चाहिए जो कि सूखी अवस्था में कड़े ठूठों को भी काट सकें। बोने योग्य खेत तथा रोपण में कम से कम कर्षण क्रियायें करनी चाहिए क्योंकि अधिक कर्षण क्रियाओं से ढूंठ छाद्यावरण भूमि में मिल जाता है। फलस्वरूप मृदा अपरक्षण तथा वाष्पीकरण बढ़ जाता है। उथले यंत्रों द्वारा कम से कम जुताईयों द्वारा यह कार्य संभव बनाया जा सकता है। बुवाई तथा निकाई-गुडाई के समय यह आवश्यक हो जाता है कि वनस्पतिक छाद्यावरण को सुरक्षित रखा जाये। बुवाई के यंत्र ऐसे हो जोकि मल्च को कम से कम बाधा करें, साथ ही बीज को इस स्थिति में रख दें कि उसका जमाव सफलतापूर्वक हो जाये। पंक्ति में बोयी जाने वाली फसलों को बोने के लिए पंक्ति से पंक्ति की दूरी ८०-१०० से० मी० तक होती है। कूंड़ों से निकली हुई मिट्टी पंक्तियों के बीच में उपस्थित फसल के

(शेष पृष्ठ ३८ पर)

खरपतवार नियंत्रण से धान की उपज बढ़ाइये

जी० बी० मान्ना, तथा अच्युता नन्द डूबे
केन्द्रीय चावल अनुसंधान संस्थान-कटक

खेती में अधिक उत्पादन प्राप्त करने के लिये यह आवश्यक है कि उपज में कमी लाने वाले सभी कारणों को हम जाने तथा उन्हें दूर करने का भरसक प्रयास करें। किसान भाई खेती में उन्नति लाने के लिये जिस प्रकार खाद, पानी, अच्छा बीज, रोग तथा कीड़ों के नियंत्रण आदि सभी आवश्यक पहलुओं पर ध्यान देते है उसी प्रकार उन्हें अपने खेत में खरपतवारों के नियंत्रण पर भी विशेष ध्यान देना चाहिये और ऐसे समय जबकि धान की सीधी बुआई खेत में की गई है, खरपतवार का नियंत्रण नितांत आवश्यक है। बिना खरपतवार नियंत्रण के अन्तर्गत विधि में उपज प्राप्त करना कठिन है क्योंकि खेत में खरपतवारों की इतनी संख्या बढ जाती है कि कभी-कभी धान के पौधों की जगह खेत में खरपतवार ही दिखाई पड़ते हैं।

केन्द्रीय चावल अनुसंधान संस्थान पर पिछले कई वर्षों से धान की सीधी बोई भूमि में खरपतवारों के नियंत्रण पर विशेष बल दिया जा रहा है तथा विभिन्न उपयोगी औषधियों के प्रयोग से इस बात की जानकारी प्राप्त की जा रही है, कि कौन सी औषधि कितनी मात्रा में किस समय खेत में प्रयोग करने से अधिक उपयोगी सिद्ध होगी, जिससे उगने वाले अथवा उगे हुये खरपतवारों का खेत में अधिक से अधिक विनाश संभव हो सके। हम जानते हैं कि धान की सीधी बुवाई दो ढंग से की जाती है जैसे धान की सीधी बुवाई सूखी भूमि पर तथा दूसरी धान की बुवाई कादो की गई भूमि पर। हम पायेंगे कि इन दो विधियों से बोई धान की फसल में प्रथम उगने वाले खरपतवार अलग-अलग होते हैं और और बाद में फिर अन्य प्रजातियों की संख्या बढ़ने लगती है। सूखी भूमि पर ग्रैमिनी प्रजाति खरपतवार पहले इतनी अधिक संख्या में उगते हैं कि साइप्रस अथवा सेज प्रजाति के खरपतवारों को संख्या खेत में नही के बराबर कहीं-कही प्रतीत होती है। इस परिस्थिति में ग्रेमिनी घासों के साथ डाईकाट खरपतवार भी उगते हैं और अपनी संख्या मे वृद्धि करते है किन्तु गीली भूमि पर जहां अच्छी प्रकार भूमि कादो करके बुवाई की जा रही है, साइप्रस प्रजाति के खरपतवार नथा डाईकट के खरपतवार अधिक संख्या में उगते हैं। यही नहीं वरन् ऐसी भूमि जहां लगातार खेत में पानी टिका रहता है कुछ शैवाल तथा पानी के अन्य खरपतवार उगते हुये नजर आते हैं। ग्रेमिनीप्रजाति के कुछ ऐसे खरपतवार भी बाद में उग आते हैं जो नमी की अधिकता में भी नीची भूमि पर अपना विकास सुचारू रूप से करते है। इस प्रकार विभिन्न परिस्थितियों में विभिन्न उगने वाले घासों के नियत्रण में ऐसी खरपतवार नाशक औषधियों का चुनाव करना चाहिये जो खेत मे पूर्ण नियत्रण कर सके तथा आगे उगने वाले खरपतवारो को खेत में जमने मे रोक सकें। इस संबंध मे रबी १९७३ में धान की बाला किस्म कादो की गई भूमि में छिटकवां विधि से बुवाई करके तथा उसमें विभिन्न खरपतवार नाशक औषधियों को विभिन्न मात्रा मे प्रयोग करके उनकी उपयोगिता का अध्ययन किया गया जैसा कि निम्न सारणी से स्पष्ट है। इस परीक्षण में टीसाईस्टारिन/ २, ४-डी (तेलरान जी) तथा प्रोपानिल २,४-डी का प्रयोग खेत में धान की बुवाई के क्रमश १० तथा २६ और ४० दिन पर किया गया था जबकि बेन्थियोकार्ब, ब्यूटाक्लोर, एविरासन (सी २८८), सी १९४९० और रोनस्टार का प्रयोग बुवाई के ६ दिन बाद किया गया था। इस समय तक एक भी खरपतवार खेत मे नहीं उग पाये थे, इनके प्रयोग के समय में खेत मे २-३ से० मी० पानी कायम रखा गया था और दानेदार औषधियों को समान रूप से पानी में छिड़का गया था। पानी की मात्रा खेत मे बराबर कायम रखी गई थी तथा बाहर पानी बहकर न जा सके ऐसी व्यवस्था की गई थी ताकि औषधि अधिक से अधिक भूमि में कारगर बन सके।

यहां हम पाते हैं उपयुर्क्त वर्णित सभी खरपतवार नाशक औषधियों मे बेन्थियोकार्ब, ब्युटाक्लोर, एविरासन, सी १९४९० तथा प्रोपानिल २,४-डी० का खरपतवार नियंत्रण में अच्छा प्रभाव पड़ता है। टीसीईस्टाइरिन/ २,४-डी० तथा रोनस्टार अधिक विषैलेपन के कारण फसल पर प्रतिकूल प्रभाव दिखाये परिणामतः उपज में कमी आई।

जैसा सारणी से स्पष्ट है कटाई के समय लिये गये प्रति वर्ग मीटर खरपतवारों का सूखा वजन भी इन दो औषधियों से उपचारित क्षेत्र में अधिक मिलता है इससे यह स्पष्ट होता है कि खरपतवार के अधिक नियंत्रण में इनका प्रभाव प्रतिकूल नहीं है वैसे बिना खरपतवार नियंत्रण के मुकाबले इन दोनों औषधियों के प्रयोग द्वारा एक टन से भी अधिक उपज में वृद्धि पाई गई तथा सबसे अधिक अर्थात दो टन से भी ज्याद वृद्धि परिणाम ब्यूटाक्लोर एवं प्रोपानिल+२, ४-डी० के प्रयोग से प्राप्त हुआ।

विभिन्न खरपतवार नाशक दवाओं का धान की सीधी कादो की गई भूमि पर प्रभाव

सारणी नं०–१

उपचार	क्रियाशील मात्रा किलो प्रति हे०	उपज कि० प्रति हे०	बिना नियंत्रण के मुकाबले उपज मे वृद्धि किलो प्रति हेक्टर	घास का सूखा वजन प्रति वर्ग मि०ग्राम मे	विषैलेपन का माप बुवाई के २५ दिन बाद	घासनियंत्रण माप बुवाई के ४५ दिन बाद
बेन्थियोकार्ब	१.५०	५८६०	१८२८	२९.२०	१.५	१.२०
ब्यूटाक्लोर	१.००	५९८३	२३४९	२०.४०	१.५	१.१०
ब्यूटाक्लोर	१-५०	५३९१	१७५७	१९ ८	१.७५	१.१३
टीमीईस्टाइरिन २,४-डी	०.६/०.४	४८०५	११७१	५८.६	२.५	१.७५
एविरासन सी-२८८	१.००	५४९८	१८६४	१९.४	१.६०	१.२५
सी १९४०	१.००	५५७६	१९४२	१९ ६	१.४५	१.१०
रोनस्टार	१.००	५०१२	१३७८	५०.६	१.६०	१.२५
प्रोपानिल तथा २,४-डी	३.०/१.०	५९७६	२३४२	२५ ०	१.४५	१.१०
हाथ द्वारा निकाई		६११२	२४७८	३.०		१.०३
बिना नियंत्रण		३६३४		१४७.०		५.०
सी डी (०.०५%)		६९५				

बिशेलेपन का माप दंड

१—कोई प्रभाई नहीं

१—फसल बिल्कुल नष्ट

घास नियंत्रण माप दंड

१—पूर्ण नियंत्रण

५—बिल्कुल नियंत्रण नहीं

दूसरी महत्वपूर्ण ध्यान देने योग्य बात यह है कि ब्यूटाक्लोर की १ किलो क्रियाशील मात्रा प्रति हेक्टर की दर से प्रयोग करने में १.५ क्रियाशील मात्रा के मुकाबले अधिक उपज प्राप्त होती है अतः सीधी बोई भूमि में ब्यूटाक्लोर की सही मात्रा का विशेष ध्यान रखना चाहिये क्योंकि अधिक क्रियाशील मात्रा के प्रयोग द्वारा जमे अथवा जमने वाले धान के कोमल पौधों एव अंकुरित पौधों पर इसके विषैलेपन का अधिक प्रभाव पड़ेगा और बहुत से अकुरित बीज एव पौधे झुलसकर मर जायेंगे इसका अंतिम परिणाम फसल की उपज पर भी पड़ेगा जैसा सारणी से स्पष्ट है, जब ब्यूटाक्लोर की १.५ किलो क्रियाशील मात्रा का प्रयोग सीधी बोई भूमि पर अंकुरित किये बीजो पर बुवाई के ६ दिन बाद किया गया तो इसके विषैलेपन का प्रभाव अधिक पडा और प्रति इकाई वर्ग-मीटर पौध संख्या कम हो गई परिणामतः उपज कम प्राप्त हुई। अतः किसी भी औषधि के प्रयोग में सबसे पहले उनकी सही मात्रा की जानकारी प्राप्त करना आवश्यक है ताकि खेत में अधिक से अधिक खरपतवार का नियत्रण हो और इनका विषैला प्रभाव फसल पर कम पड़े।

प्रोपानिल+२,४-डी का प्रयोग खेत में घासों के उगाने के २६ तथा ४० दिन बाद क्रमशः किया गया था जबकि टीमीईस्टारिन २,४-डी का प्रयोग बुवाई के १० दिन बाद किया गया और इस समय खेत में खरपतवार उगे थे। प्रोपानिल द्वारा साइप्रस प्रजाति के खरपतवारों का अच्छा नियंत्रण प्राप्त हुआ। बचे हुये बाद में उगने वाले डाईकट तथा साइप्रस प्रजाति के खरपतवारों का नियत्रण २,४-डी द्वारा बुवाई के ४० दिन बाद प्रयोग करने पर अच्छा प्राप्त हुआ। इस परीक्षण में ब्यूटाक्लोर तथा प्रोपानिल+२,४-डी के प्रयोग का उपज पर संतोषजनक परिणाम मिला। बेन्थियोकार्ब १.५ किलो क्रियाशील मात्रा, सी १९४९० तथा एविरासन की १ किलो क्रियाशील मात्रा प्रति हेक्टर की दर से प्रयोग करने पर पाया गया कि खरपतवार नियंत्रण तथा उपज में वृद्धि का इनके द्वारा अच्छा परिणाम हुआ। अतः हमें

(शेष पृष्ठ ३९ पर)

बुन्देलखंड के बारानी क्षेत्रों के लिए ट्रिटेकेल की खेती

वासदेव एवं डा० हरिशंकर

मृदा एवं कृषि रसायन अनुभाग,
चन्द्र शेखर आजाद कृषि प्रौद्योगिक वि० वि०, कानपुर-२

ट्रिटेकेल सन् १८७६ में विल्सन नाम वैज्ञानिक द्वारा इंगलैंड में निकाला गया। यह गेहूं एवं एक जंगली गेहूं जिसको राई के नाम से जाना जाता है, मिला कर बनाया गया। राई, घास कुल का सदस्य है। इस प्रकार ट्रिटेकेल (गेहूं) एवं सीकेल (राई) को मिलाकर ट्रिटेकेल नाम दिया गया। इसमें गेहूं के अधिक उपज देने एवं राई के सूखा सहन करने का गुण पाया जाता है। इस प्रकार लम्बे एवं बौने दोनों प्रकार के गेहूं जाति से लम्बे एवं बौने जाति का ट्रिटेकेल विकसित किया गया। ट्रिटेकेल में दो तिहाई गुण गेहूं का तथा एक तिहाई गुण राई का पाया जाता है। भारतवर्ष में हरित क्रान्ति केवल उन्हीं क्षेत्रों में सफल रही है जहां सिंचाई की विशेष सुविधाए एवं रासायनिक उर्वरक उचित मात्रा मे प्राप्त हो सके। अतः उन क्षेत्रो में जहां न तो पानी और न उर्वरक की विशेष सुविधा हो एक ऐसी फसल का उत्पादन करना है जिसको कम पानी तथा कम उर्वरक की आवश्यकता हो, ट्रिटेकेल ही एक ऐसी फसल है जिममें दोनों गुण पाये जाते हैं।

हमारे देश मे प्रायः जौ के पूरे क्षेत्र एवं लगभग ६० प्रतिशत गेहूं के क्षेत्र केवल वर्षा के पानी पर ही निर्भर होते हैं इस प्रकार प्रायः वर्षा कम होने पर उपज कम मिलती है या कभी-कभी फसल बीच में ही सूख जाती है, परन्तु ट्रिटेकेल में यह गुण नही पाया जाता है। यह असिंचित क्षेत्रों में लगभग गेहूं के बराबर उपज देती है। इसकी खेती सिंचित क्षेत्रो मे भी की जा सकती है। शुष्क क्षेत्रो मे लोकप्रियता के मुख्य कारण, इसकी लम्बी बालें, प्रति बाल दानो की अधिक सख्या जिससे अधिक उपज, मुख्य जड गहराई तक जाकर पूरे खाद एव पानी का उपभोग, भूमि में कम नमी पर बीज के जमने की क्षमता आदि के कारण है।

इस प्रकार उपरोक्त बातों को ध्यान में रखते हुए बुन्देलखण्ड जहां ८० से लेकर १०० से०मी० तक वार्षिक वर्षा होती है ग्रीष्म ऋतु शुष्क एवं गर्म होती है शीत ऋतु में यहां खूब जाड़ा पड़ता है ट्रिटेकेल की खेती किस प्रकार से की जाय इसका संक्षिप्त वर्णन किया गया है।

बुन्देलखण्ड का क्षेत्र यमुना नदी के दक्षिण-पश्चिमी क्षेत्र में स्थित है और झांसी, जालौन, हमीरपुर बांदा जिलों में फैला हुआ है। इस खण्ड की भूमियों को चार भागों मे बांटा गया है।

टाइपः १:—भूमि

इस भूमि को प्रायः राकड़ भूमि कहते हैं इस भूमि का रंग गहरा भूरा और भूमि कण बड़े होते है। यह भूमि बहुत ही उथली है और इसके नीचे सख्त चट्टाने पायी जाती हैं हल्की भूमि होने के कारण इसमें जल धारण शक्ति बहुत ही कम होती है तथा जीव अंश की मात्रा कम पायी जाती है इसमे ट्रिटेकेल की खेती सफलता पूर्वक नही की जा सकती है।

टाइपः २ :भूमि

यह भूमि कम ढाल अथवा समतल मैदानों में पायी जाती है यह भूमि भूरे रंग की होती है इसमे भुड़ (बालू) से लेकर मटियार किस्म की भूमि आती है यह भूमि काफी गहरी होती है और नीचे काकड़ मिलता है। इसमें जल-धारण तथा जीव अंश की मात्रा अधिक होती है इसकों प्रायः कावड़ कहते है इसमे ट्रिटकेल की खेती बिना सिचाई के सफलतापूर्वक की जा सकती है।

टाइपः ३ :भूमि

इसको प्रायः पड़वा भूमि कहते हैं यह निचले अथवा मैदानी भागों मे पायी जाती है इसका रंग गहरे भूरे रंग से लेकर भूरे रंग तक पाया जाता है। इसमें जीव अंश तथा जल-धारण क्षमता कावड़ भूमि से कम होती है। फसल में फूल आने पर सिचाई की आवश्यकता पड़ती है।

टाइपः ४ :भूमि

इस भूमि का रंग गहरा काला होता है इसमें आवश्यक तत्वों की मात्रा जैसे नत्रजन, फास्फोरस, पोटाश अधिक पायी जाती है। इसको माड़ भूमि कहते है इसका गुण मटियार दोमट के समान है इसकी तुलना मध्य भारत के ब्लैक काटन मृदा से की गई है। ट्रिटेकेल की असिंचित खेती इसी भूमि में अच्छी तरह होती है।

इस प्रकार माड़ और कावड़ भूमि ट्रिटेकेल की खेती के लिए सर्वोत्तम है इसमें सिंचाई की जरूरत नहीं पड़ती है।

बुवाई का समय

असिंचित (बारानी) क्षेत्रों मे ट्रिटेकेल की बुआई अक्टूबर के दूसरे या तीसरे सप्ताह के अन्त तक समाप्त कर देनी चाहिए इसके बाद जितनी देर होगी उतनी ही पैदावार कम होती जायेगी। २० अक्टूबर के लगभग बारानी क्षेत्रों में बुआई समाप्त कर देनी चाहिए।

खेत की तैयारी

बुन्देलखण्ड के क्षेत्रों में खरीफ में कम फसल उगाते हैं प्रायः मूंग, तिल अथवा ज्वार की खेती करते हैं। जिन क्षेत्रों में गेहूं

तथा जौ बुवाई होती है उनको खरीफ मे खाली रखते है खेत की तैयारी करते समय उसमें वक्खर चलाते हैं तथा ३-४ बार चलाने से खेत तैयार हो जाता है बडे क्षेत्रों में ट्रैक्टर में कल्टी-वेटर लगाकर तैयार करते हैं मिट्टी पलटने वाले हलो से गर्मी में जुताई करते हैं।

बुवाई की विधि

बुवाई कूड़ों में की जाती है। इसके लिए हल के पीछे पार लगाकर करते है। ट्रैक्टर-चलित सीडड्रिल भी बुवाई के लिए ठीक रहता है।

बीज की मात्रा

१०० कि०ग्रा० बीज की आवश्यकता प्रति हे० होती है। उर्वरक एवं बुवाई के समय के अनुसार इसकी मात्रा में घटाव बढ़ाव होता रहता है। इसकी मात्रा ६०-१२० कि०ग्रा० प्रति हे० तक भी हो सकती है।

खाद की मात्रा

एक नई फसल होने के कारण ट्रिटेकेल के लिए उचित खाद की मात्रा का ज्ञान बहुत ही कम है। शुष्क क्षेत्रों में उर्वरकों के प्रयोग से अधिक लाभ प्राप्त करने के लिए अत्यन्त आवश्यक है कि उनकी सही मात्रा प्रयोग की जाय। आवश्यक मात्रा से कुछ लाभ नहीं होगा आर्थिक दृष्टिकोण से बारानी क्षेत्रों मे खाद की मात्रा का बहुत ही महत्व है प्रयोगों के आधार पर यह तथ्य ज्ञात है कि बारानी क्षेत्रों में ४० कि० ग्रा० नत्रजन, ३० कि० ग्रा० फास्फोरस तथा २० कि० ग्रा० पोटाश देकर ट्रिटेकेल की उपज लगभग गेहूं के बराबर प्राप्त हुई है। बुन्देलखण्ड के क्षेत्र में प्रयोगों के आधार पर ट्रिटेकेल के लिए बारानी क्षेत्रों मे अधिक से अधिक ६० कि० ग्रा० नत्रजन, ४० कि०ग्रा० फास्फोरस तथा ३० कि० ग्रा० पोटाश देकर अच्छी उपज प्राप्त की जा सकती है।

खाद देने की विधि

बारानी क्षेत्रों मे खाद देने की विधि का उपज पर काफी प्रभाव पड़ता हैं अतः खाद देते समय कुछ विशेष बातों को ध्यान में रखना आवश्यक हैं जैसे नत्रजनित उर्वरकों को पौर द्वारा कूड़ में देना चाहिए जो कि बीज में ठीक २ इंच नीचे तक पड़े जिससे जड़ों के नीचे तक जाकर खाद एवं पानी दोनों का उपयोग कर सके। नत्रजनित उर्वरकों का पर्णीय छिड़काव भी उपज बढ़ाने में सहायक हुआ है। फास्फोरस एवं पोटाश की पूरी मात्रा बुवाई के समय कूड़ों में देना चाहिए। बारानी क्षेत्रों में छिड़काव ढंग से उर्वरकों के प्रयोग से आर्थिक हानि होती है तथा उपज कम प्राप्त होती है।

खरपतवार

अगर खरपतवार उग आवें तो उनको निराई करके खेत को साफ कर देना चाहिए क्योंकि ये मुख्य फसल की खाद एवं पानी दोनों का उपयोग करते है जिससे उपज कम हो जाती है।

कटाई

फसल गेहूं से कुछ अधिक दिन लेती है इस प्रकार जब सुनहरे पीले रंग की बालियां दिखाई देने लगें तो ट्रिटेकेल की कटाई कर लेनी चाहिए।

उपज

करीब २५-३० क्विन्टल तक हो जाती है भूसे की उपज ४० से ६० क्विन्टल तक होती है प्रयोगो के आधार पर बारानी क्षेत्रों मे ट्रिटेकेल की अधिकतम उपज ३६ क्वि० प्रति हे० प्राप्त हुई है।

जातियां

इसमें लम्बी एवं बौनी दोनों प्रकार की जातियां विकसित की गई है इसमे आरमिडलों, ब्रान्कों, रोजनर, टाइप ४-४ आदि जातियां विकसित की गई है जो कि इस समय गोविन्द वल्लभ पन्त कृषि एव प्रौद्योगिक विश्वविद्यालय, पंतनगर, नैनीताल से मिल सकते हैं।

बीमारियां

ट्रिटेकेल गेहूं एव राई को मिलाकर बनाया गया है इस प्रकार इसमें दोनों के गुणों का प्रवेपण हुआ है यह बिमारियों के प्रति-रोधी है यह गुण राई के कारण इसमे प्रवेशित हुआ है क्योंकि राई की फसल रोगों की प्रतिरोधी है। उत्तरी अमेरिका में कही-कही कुछ जातियो मे गेरुई रोग का प्रकोप देखा गया है। मैक्सिकों मे एक बीमारी और देखी गई है जो कि एक विशेष बेक्टीरिया द्वारा फैलती है। यह गेहूं के कारण आता है जो कि वंशानुवंश है परन्तु अब ट्रिटेकेल रोधी गेहूं और राई को मिलाकर विकसित किया गया है जो रोगों का प्रतिरोधी है। हमारे देश में अभी तक किसी रोग का प्रकोप नहीं देखा गया है।

पोषक गुण एवं उपयोग

ट्रिटेकेल की अधिक लोक प्रियता से उगाये जाने का मुख्य कारण इसका पोषक गुण है जो कि मनुष्य एवं पशुओं के लिए विशेष उपयोगी है। इसमें प्रायः २० प्रतिशत प्रोटीन पायी जाती है जो कि अन्य फसलों की तुलना में जैसे गेहूं करीब १३ प्रतिशत, जौ १२ प्रतिशत, मक्का १० प्रतिशत तथा चावल के ८ प्रतिशत प्रोटीन से करीब दो गुणी ज्यादा है। इसमें प्रोटीन मे आवश्यक सभी एमीनों-अम्ल मुख्यतः लायासिन अधिक मात्रा में (३ ग्रा०। १०० ग्रा० प्रोटीन) पाया जाता है। वैज्ञानिकों के अनुसार इसके प्रोटीन का गुण शरीर भार बढ़ाने में अण्डे के प्रोटीन जैसा कार्य करता है।

इसके अतिरिक्त इसके आटे से अच्छे किस्म की रोटी तैयार की जा सकती है। प्रोटीन की अधिकता के कारण ट्रिटेकेल के आटे से नवजात शिशु के लिए व्यवसायिक रूप से दुग्ध आहार बनाने के लिए प्रयोग में लाया जा रहा है। अन्य खाद्य सामग्री जैसे पाराठा, पूरी, बिस्कुट, आदि सरलता पूर्वक अच्छे किस्म के तैयार किए जा रहे हैं।

पौधा संरक्षण दवाइयां शरीर में प्रवेश कर जाने पर क्या करें ?

सुरेश चन्द्र मंडल

सहायक कीट विशेषज्ञ कृषि अनुसंधान शाला, सबौर भागलपुर (बिहार)

कृषि की बदलती हुई पद्धति में पौधा संरक्षण का महत्व दिनों दिन बढ़ता जा रहा है और कीड़े एवं पौधा रोग की समस्याओं के समाधान के लिए विभिन्न प्रकार के नवीन पौधा संरक्षण रसायन व्यवहार में लाये जाने लगे हैं। यह बहुत ही आशापूर्ण पहलू है। परन्तु समस्या का दूसरा पहलू है, इन विषैली पौधा संरक्षण दवाइयों से सावधान रहना। इन रसायनों के सम्बन्ध में पूर्ण जानकारी नहीं रहने के कारण आये दिन किसान उनके प्रयोग में ऐसी-ऐसी भूल कर बैठते हैं जिनसे कभी-कभी अप्रत्याशित घटनाएं घट जाती हैं वह असावधानी जान लेवा सिद्ध होती है। अतः फसल की सुरक्षा के साथ-साथ किसानों को अपनी सुरक्षा के लिये इन रसायनों के व्यवहार में काफी सावधानी बरतने की आवश्यकता है।

विषैलेपन के ख्याल से पौधा संरक्षण दवाइयों को तीन श्रेणी में विभक्त किया जा सकता है—अत्यंत विषैला रसायन, मध्यम श्रेणी का विषैला रसायन और सबसे कम विषैला रसायन।

जिंक फौसफाईड, बैरियम कार्बोनेट, साइमग, एन्हीन, मैथाईल ब्रोमाईम, गग्रोसन, सेरेसन, पाराथियन, आदि अत्यंत विषैले रसायनों की श्रेणी में आते हैं। डी० डी० टी०, बी० एच० सी० क्लोवडैन, हैप्टाक्लौर, अल्हीन, मालाथियेन, डाईमेक्रौन आदि मध्यम श्रेणी के विषैले रसायन हैं। पायरेथ्रम, पायरोकोल्वायड, पायरोडस्ट, ताम्र रसायन, निकोटीन, आदि सबसे कम विषैले रसायन हैं।

यदि किसान इन पौधा संरक्षण दवाइयों के प्रयोग में साधारण चेतावनी पर अमल करें तो वे बहुत हद तक जोखिम से अपनी सुरक्षा कर सकते हैं। विषैले रसायनों की शीशी या डिब्बे पर यदि रसायनों का नाम साफ-साफ नहीं लिखा हो तो साफ-साफ लिख देना चाहिए ताकि तेल, आटा, सत्तू आदि के धोखे में वे खाने के प्रयोग में न आ जांय। उन रसायनों को भंडार घर, खाद सामग्री, बच्चे, मवेशी, एवं अन्य पालतू जानवर से दूर किसी एकांत सुरक्षित जगह पर ताला बंद कमरे में रखना चाहिए। दवा प्रयोग के बाद खाली बोरे, शीशी, डिब्बे आदि को कभी भी घरेलू कार्य में व्यवहार नहीं करना चाहिए। उन्हें जमीन में गाड़ देना चाहिए या नष्ट कर देना चाहिए।

पौधा संरक्षण दवाइयों के प्रयोग के समय भी काफी सावधानी बरतने की जरूरत है। रसायन के पात्र की ठेपी या ढक्कन खोलते समय अपने मुँह और नाक पर रुमाल रख लें और भूल से भी रसायन को न सूँघें। रसायनों को हाथ से कभी न छुयें। यदि सम्भव हो तो रसायन प्रयोग के समय रबर के दस्ताने, गमबूट, रेसपिरेटर, गोगुल्स, आदि का व्यवहार करें। प्रयोग के समय प्रयोगकर्त्ता को हवा के रुख के विपरीत खड़ा रहना चाहिए ताकि रसायन घोल या चूर्ण शरीर पर न पड़ जाय। पौधा संरक्षण यंत्र जैसे स्प्रेयर या डस्टर यदि काम करते-करते अवरुद्ध हो जांय तो उन्हें मुँह से फूंककर कभी साफ नहीं करें। दवा प्रयोग के समय खान-पान और धूम्रपान नहीं करें। प्रयोग के बाद अपने शरीर के वस्त्र को तुरंत बदल लें और उन वस्त्रों को साबुन से साफ कर लें। प्रयोग के बाद बचे हुए रसायन घोल को नदी, तालाब आदि में कदापि न डालें बल्कि गड्ढा खोद कर उसमें डाल दें। चूहा दमन हेतु घर या घर के बगल वाले गोदाम में सायनोगैस का प्रयोग कभी न करें। रसायन से उपचारित शाक सब्जियों का प्रयोग उपचार के कम से कम एक सप्ताह बाद ही करें।

इतनी सावधानी के बाद भी यदि पौधा संरक्षण दवाइयां मनुष्य के शरीर में प्रवेश कर जांय तो सर्वप्रथम कै कराना चाहिए। एक गिलास गर्म जल में करीब पचास ग्राम सरसों की बुकनी, नमक या साबुन का घोल पिलाने से कै हो जायगी। परन्तु यदि रोगी विषैले रसातन के प्रभाव से ही कै कर रहा हो तो उसे अलग से कै कराने की जरूरत नहीं है। उसे पीने के लिए ठंडा जल दिया जा सकता है। कै होने के बाद मक्खन खिलाना चाहिए या दूध या जल में अंडे की सफेदी घोल कर पिलाना चाहिए। यदि विषैला गैस सूंघने के कारण रोगी बेहोश हो गया हो तो उसे खुली हवा में रखना चाहिए। उसके शरीर का वस्त्र ढीला कर देना चाहिए। यदि रोगी घर के अंदर रक्खा गया हो तो घर के दरवाजे एवं खिड़कियों को एकदम खोल देना चाहिए ताकि रोगी को स्वच्छ हवा प्राप्त हो सके।

यदि रोगी को मूर्छा, सिरदर्द, श्वांस लेने में ऐंठन आदि महसूस होती हो तो उसे एट्रोहिन सल्फेट या बेलाफोलिन की दो टिकिया खिलानी चाहिए। आवश्यकता पड़ने पर इसे दोहरा भी सकते हैं। यदि इससे भी रोगी चंगा न हो तो एक मिलीग्राम एट्रोपिन सल्फेट हर एक घंटे के हिसाब से १२ से ३६ घंटे

तक सूई लगावें। सुई नसों, मांस पेशियों या चमड़े के ठीक नीचे लगानी चाहिए।

यदि बी० एच० सी, डी० डी० टी०, आल्ड्रिन, हैप्टाक्लोर आदि रसायन रोगी के पेट में चला गया हो तो पहले रोगी को कै कराना चाहिए। इसके बाद मैगनेशियम सल्फेट घोल कर पिलाना चाहिए। जरूरत पड़ने पर १० प्रतिशत कैल्शियम ग्लूकोनेट का १० मि० ली० और १० मिली ग्राम फिनोबार्बीटोल की नसों में सूई भी दी जा सकती है। कुछ देर बाद कौफी या गर्म चाय पिलानी चाहिए।

यदि किसी ने जिंक फासफाईड खा लिया हो तो उसे तुरंत कै कराना चाहिए। कै कराने के बाद एक ग्लास गर्म जल में २५ ग्राम पोटेशियम परमैगनेट का घोल मिलाना चाहिए। इसके १० मिनट बाद आधा चम्मच तूतिया जिसे कापर सल्फेट भी कहते हैं, एक गिलास पानी में घोल कर पिलाना चाहिए। अंत में १५ मिनट बाद एक गिलास पानी में १५ ग्राम मैगनेशियम सल्फेट घोलकर पिलाना चाहिए।

सायनोगैस के प्रभाव से रोगी को मुक्त करने के लिए सबसे पहले एमाइल नाइट्रेट का १५ मिनट के अन्तर पर ५ सेकेड सुँघाना लाभप्रद होगा। इसके बाद एक-एक घंटे के अन्तर पर तीन प्रतिशत सोडियम नाइट्रेट की ढाई मिली लिटर के हिसाब से ३-४ सुई लगानी चाहिए।

अभी जिन सावधानियों, प्राथमिक चिकित्सा एवं औषधि उपचार का उल्लेख किया गया है, वे केवल संकट की घड़ी में सहारा मात्र हैं। योग्य चिकित्सक की शरण में जाना अत्यंत आवश्यक है। डाक्टर की सुविधा के लिए ऊपर बताई गई औषधियों का उल्लेख करना चाहिए ताकि रोगी की चिकित्सा में उन्हें कुछ मदद मिल सके।

(पृष्ठ ३२ का शेष)

अवशेषों की ढक देती है जिससे खरपतवार फसलों के साथ प्रतिस्पर्धा नहीं कर पाते है।

(३) मृदा से जल हानि को रोकना

वाष्पीकरण, खरपतवार तथा अपवाह (run off) द्वारा पर्याप्त मात्रा में जल की हानि होती है। मृदा सतह कर्षण यंत्र खरपतवार को नष्ट करने तथा भूमि की सतह पर भूरभुरी मिट्टी की एक मल्च बनाने में काफी सहायक होते हैं। ढूँठ छाद्यावरण अधो भूमि को ऊपर करने तथा गहरी जुताई करने से अभेद्य पर्त टूट जाती है। अतः अपवाह द्वारा होने वाली हानि बहुत सीमा तक कम हो जाती है।

(४) उचित शस्य पद्धतियां

शुष्क क्षेत्रों में वर्ष में अधिक समय तक एक ही फसल उगाना सामान्य क्रिया है। यदि खरीफ में फसल ली जाती है तो रबी में पड़ती छोड़ दी जाती है तथा यदि रबी में फसल उगाते हैं तो खरीफ में पड़ती रखते हैं। इन क्षेत्रों में खरीफ के पश्चात् दूसरी फसल लेने में सबसे बड़ी बाधा है रबी में बोये जाने वाले बीजों के उगने की समस्या। लेकिन यदि मृदा की नमी के अनुसार फसलों का चुनाव बोने के लिए किया जाये तो दोनों फसलें बड़ी अच्छी प्रकार से ली जा सकती हैं क्योंकि किन्हीं फसलों के लिए अधिक नमी की आवश्यकता होती है तो किन्ही के लिए कम। जैसे गेहूं के लिए अधिक नमी चाहिए इसके विपरीत चना कम नमी में भी अच्छी उपज दे सकता है। इसके अलावा मृदा से नमी ग्रहण करने की क्षमता भी विभिन्न फसलों की विभिन्न होती है। सारणी—१ से स्पष्ट है कि चना, जौ इत्यादि गेहूं, मटर की अपेक्षा मृदा से नमी ग्रहण करने की अधिक क्षमता रखते हैं।

सारणी—१

विभिन्न फसलों की मृदा से नमी ग्रहण करने की क्षमता

फसल का नाम	मृदा से नमी ग्रहण करने की प्रतिशत क्षमता
चना (एन० पी० ५८)	२६
जौ (एन० पी० १४)	२४
अलसी (एन० पी० आर० आर०-८)	१५
जई	१३
मटर	१०
गेहूं (एन० पी० ७१८)	५

प्रयोगों से सिद्ध हो चुका है कि बारानी दशाओं में गेहूं एन० पी० ८७६ (३३०१ किलो/है०), एस २२७ (३४९२ कि० है०), एन० पी० ८६० (२९१३ कि/है०), ज्वार टाइप ४९८९ (२५६० कि है०), आर० एस० ३१-१ (२४५८ कि०/है०), टाइप ५००५ (२२५७ कि०/है०), टाइप ५००३ (२१०५ कि०/है), शंकर बाजरा-२३ ए जे-८७ (११३३ कि०/है०), एच० वी०-३ (९५४ कि०/है०), मूँगफली टी० एम० वी० ४,३ और १ अति उत्तम सिद्ध हुई है। इसके अलावा अरहर, मूँग, उर्द, चना, गेहूं, जौ इत्यादि भी अच्छी तरह उग सकते हैं।

असिंचित क्षेत्रों में मिश्रित खेती काफी लाभप्रद रहती है क्योंकि एक फसल के असफल हो जाने पर दूसरी फसल से कुछ न कुछ आय हो जाती है। गहरी जड़ वाली फसलों को उथली जड़ वाली फसलों के साथ उगाने से फसल की जल-शोषण क्षमता में पर्याप्त वृद्धि होती है। गहरी तथा उथली जड़ वाली फसलों के कुछ मिश्रण निम्नांकित है—जौ+चना, जौ+सरसों, जौ+अलसी, गेहूं, सरसों, ज्वार,+अरहर, ज्वार, मूँगफली इत्यादि।

इस प्रकार बारानी प्रक्षेत्र दशाओं में विभिन्न प्रकार के फसल चक्रों को अपनाया जा सकता हो। कुछ उदाहरण निम्नलिखित है

(१) गेहूं-बाजरा (२) गेहूं-बाजरा-चना (३) जौ-ज्वार-चना (४) सूर्यमुखी-ज्वार। लेकिन कुछ फसल चक्र अपनाने से कृषकों को अधिक लाभ मिलता है जैसा कि सारणी-२ से स्पष्ट है।

सारणी २—

विभिन्न फसल चक्रों द्वारा उत्पादन ।

फसल चक्र	उपज क्वि/है० में
१. गेहूं-बाजरा	६.८
२. गेहूं-बाजरा-चना	२१.३
३. जौ-चना	३०.६

(५) उर्वरकों की उचित मात्रा एवं सही प्रकार से प्रयोग

अभी तक कृषकों की आम धारणा रही है कि बारानी क्षेत्रों में उर्वरक प्रयोग से कोई लाभ नहीं होता है लेकिन प्रयोगों से सिद्ध हो चुका है कि अगर नमी संरक्षण की उचित विधियां अपनाई जायें एवं उर्वरकों का प्रयोग किया जाये तो उपज में आशातीत वृद्धि होती है, अभी तक के प्रयोगों से पता चलता है कि जौ तथा गेहूं की आर्थिक वृद्धि एवं अधिक उपज के लिए लगभग ४० किलो नत्रजन की जरूरत पड़ती है जो कि आधा १८ से० मी० एवं आधा १० से० मी० की गहरायी पर दिया जाना चाहिए । फास्फोरस का प्रयोग भी जरूरी होता है । औसतन २० किलो फास्फोरस के साथ विभिन्न फसलें अच्छी उपज देती है । साधारण रूप से पोटाश की आवश्यकता नही होती है उर्वरकों की मात्राएं विभिन्न फसलों के लिए क्या हों ? इसके लिए मृदा परीक्षण का सहारा लिया जाना चाहिए ।

खादों एवं उर्वरकों के प्रयोग से अधिकतम उत्पादन एवं लाभ मुख्यतया इस बात पर निर्भर करता है कि उर्वरकों को किस प्रकार से प्रयोग किया जाये । प्रयोगों से यह देखा गया कि छिड़काव विधि की अपेक्षा (Placement) विधि से उर्वरक प्रयोग करने पर ७.६६ क्वि०/है० की उपज अधिक मिली । इसी प्रकार सारणी ३ से स्पष्ट है कि विभिन्न विधियों एवं मात्राओं का मूँग की उपज पर बड़ा अच्छा प्रभाव पड़ता है ।

सारणी—३

विभिन्न प्रकार से प्रयोग करने के ढंगों एवं उर्वकों की मात्राओं का मूँग की उपज पर प्रभाव

प्रतिपादन	छिटकवां	बीज के साथ	बीज के नीचे
१. नत्रजन २५ कि०/है०	५.६६	६.३८	७.३८
२. २५ कि० नत्रजन + ३३ कि० फास्फोरस/है०	७.७३	८.७७	१०.३२
३. २५ कि० नत्रजन + ६६ कि० फास्फोरस/है०	९.७३	९.७०	१३.२६
४. नियंत्रण		४.७०	

वारानी क्षेत्रों में नत्रजन के छिड़काव से भी अच्छे परिणाम प्राप्त हुए हैं जो कि सारणी ४ से स्पष्ट है । इसका कारण यही है कि जो नत्रजन हम छिड़काव करते हैं वह सबका सब पौधों को मिल जाता है । इसके विपरीत भूमि में दिए गये नत्रजन का नमी के अभाव में पूर्ण उपयोग नहीं हो पाता है ।

सारणी ४

यूरिया के छिड़काव एवं मृदा में डालने का गेहूं (कल्याण सोना) के दाने के उपज पर प्रभाव

नत्रजन देने की दर कि०/है०	दाने की उपज कु/हैं कुल मात्रा मृदा में	१/२ मृदा + १/२ छिड़काव
२०	२३.७	३६.३
४०	३१.३	३२.८
६०	३६.९	३६.७
८०	३७.३	३७.७
नियंत्रण	२०.१	

इस प्रकार यह स्पष्ट है कि प्राप्त जल का उचित क्रियाओं द्वारा मृदा में पूर्ण शोषण हो सकता है और शोषित जल का उपयोग, उत्पादन के अन्य कारकों में उचित ताल-मेल बिठाकर बढ़ाया जा सकता है । उपरोक्त विवरण के आधार पर बारानी क्षेत्रों से भी अन्य सामान्य क्षेत्रों की भांति सफल उत्पादन लिया जा सकता है ।

(पृष्ठ ३४ का शेष)

खरपतवार नियंत्रण में इन औषधियों के प्रयोग द्वारा उपज में वृद्धि लाने के लिये विशेष ध्यान देना चाहिये और धान की सीधी बुवाई पर बल भी देना चाहिये क्योंकि इस ढंग से धान उत्पादन में श्रम तथा समय की बचत होती है और उपज रोपण के बराबर प्राप्त होती है । उपर्युक्त खरपतवार नाशक दवाओं में निम्नलिखित बातों पर विशेष ध्यान देना चाहिये ।

(१) प्रोपानिल का प्रयोग उस समय करना चाहिये जबकि खेत में सभी घास उग आये हों और कम से कम उनमे २-३ पत्तियां निकल आई हों । धान की कादो की गई सीधी बोई भूमि में प्रायः यह अवस्था १८-२० दिन पर आती है जबकि सूखी बोई भूमि पर एक हफ्ते पर ही खरपतवार इस अवस्था को प्राप्त हो जाते हैं अतः किसान भाइयों को इस महत्वपूर्ण तथ्य सदैव ध्यान देना चाहिये और खरपतवार की अनुशंसित वृद्धि अवस्था पर ही प्रोपानिल का छिड़काव करना चाहिये । जहां पर दानेदार औषधि प्रयोग की बात है इसे सदैव घासपात उगने के पूर्व खेत में पानी की उपस्थिति में करनी चाहिये । इससे हम औषधि की उपयोगिता में वृद्धि पाते हैं ।

(२) फिनाक्सी वर्ग वाले खरपतवार नाशक औषधियाँ जैसे २.४-डी अथवा एम०सी०पी०ए० आदि का प्रयोग सीधी बोई भूमि में देर से करना चाहिये ताकि उनके विषैलेपन का अधिक प्रभाव फसल पर न पड़े । इन सबका छिड़काव समान रूप से खरपतवारों पर करना चाहिये अतः छिड़काव करते समय नाजिल को झुकाकर खरपतवारों की ओर दिशा देकर करना चाहिये ताकि औषधि अधिक से अधिक खरपतवारों के स्पर्श में आ

सके। यद्यपि ये सब मौलिक बातें हैं किन्तु औषधि की उपयोगिता बढ़ाने में बहुत महत्वपूर्ण है जिन्हें सदैव ध्यान में रखना चाहिये।

(३) ऐसी औषधि जिसमें २,४-डी का भी एक भाग क्रियाशील मात्रा मिश्रित हो जैसे टीसीईस्टारिन/ २,४-डी, उसका प्रयोग धान की सीधी बोई भूमि में ऐसे समय में करना चाहिये जबकि इसके विषैलेपन का प्रभाव फसल पर कम पड़े अन्यथा पौधों की वनस्पतिक एवं जड़ वृद्धि पर इसका विशेष प्रभाव पड़ेगा और वृद्धि-गति कुछ दिनों के लिये शिथिल पड़ जायेगी तथा पत्तियां ऐंठती हुई दिखाई पड़ने लगेंगी।

(४) तेज वायु में औषधि प्रयोग खेत में नहीं करना चाहिये। घोल रूप में प्रयोग किये किये जा रहे औषधि का, जिस प्रकार हवा की तीव्र गति में, छिड़काव समान रूप से खेत में नहीं हो पाता उसी प्रकार दानेदार औषधि भी तेज हवा की गति में एक समान खेत में बिखर नहीं पाती, अतः समान वितरण और अधिक से अधिक खरपतवार नियंत्रण के लिये शांत वातावरण में औषधि का छिड़काव अधिक उपयोगी होता है। खेत में झुककर औषधि प्रयोग करना चाहिये ताकि बहुत महीन कण वाली औषधियों का वितरण समान हो। हवा की गति में यदि छिड़काव किया जा रहा हो तो इस सावधानी पर विशेष बल देना चाहिये।

बारानी भूमि में उर्वरक डालना अधिक प्रभावी तरीका

भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली के वैज्ञानिकों ने बारानी भूमि में उर्वरक डालने का एक तरीका निकाला है। इस तरीके से फसल उर्वरकों का पूरा उपयोग कर लेती है।

अधिकांश बारानी इलाकों की मुख्य समस्या यह है कि वहां फसलों की बढ़वार अच्छी नहीं होती और भूमि में डाले गये उर्वरकों का फसल को कम लाभ पहुंचता है। इसको यंत्र द्वारा बीज की सतह के नीचे तरल उर्वरक डाल कर हल किया जा सकता है परीक्षणों में गेहूं में इस विधि से उर्वरक डालने पर सामान्य विधि की अपेक्षा प्रति हैक्टर २० क्विन्टल ज्यादा पैदावार मिली। भूमि में इतनी खुश्की थी कि फसल मुरझाने की अवस्था में थी। लेकिन नम मौसम में भी सामान्य विधि से उर्वरक डालने पर प्रति हैक्टर लगभग २६ क्विन्टल पैदावार मिली जबकि नयी विधि से ३३ क्विन्टल। इसके अलावा फसल का जमाव भी शत प्रतिशत हुआ।

नयी विधि से ऊपर की नम मिट्टी और बीज को सतह के बीच नमी तथा पोषक तत्व दोनों हो गये। जिससे फसल अच्छी पैदावार देने लायक हो गयी। ऐसा करने से फसल ने खुराक का पूरा-पूरा उपयोग किया तथा बढ़वार भी खूब हुई।

यंत्र द्वारा तरल उर्वरक डालना एक विशिष्ट कार्य है इसलिए इसे विशेष विधि से ही डालना चाहिये।

प्याज की सुधरी किस्में पैदावार तथा भंडारण में अच्छी

पूसा रत्नार और पूसारैड प्याज की दो सुधरी किस्में हैं। इनसे किसानों को अच्छा मुनाफा मिल सकता है।

इन किस्मों की सबसे महत्वपूर्ण बातें ये हैं कि इन्हें घरों मे भी काफी समय तक अच्छी हालत में रखा जा सकता है और भारी पैदावार देने वाली तो हैं ही।

पूसा रत्नार भारतीय अनुसंधान संस्थान की नवीनतम किस्म है। इसकी गाठें बड़ी, लाल, कुछ-कुछ चपटी, गोलाकार, तथा लुभावनी होती है। इसकी पत्तियां भी सुन्दर तथा गहरे हरे रंग की होती हैं। फसल तैयार होते समय इसकी गांठें मिट्टी से कुछ बाहर होती हैं। अनुकूलतम परिस्थितियों में इसकी फसल को पकने में लगभग १५० दिन लगते हैं। इसकी प्रति हैक्टर ५०० क्विन्टल तक पैदावार मिल सकती है। सामान्य परिस्थितियों में इसकी लगभग ४०० क्विन्टल पैदावार मिलती है।

पूसा रैड को कुछ किसान पहले से ही उगा रहे हैं। इसकी गांठे मध्यम आकार की कांसे की तरह लाल तथा गोलाकार होती हैं। और इसकी फसल १६० दिन में तैयार हो जाती है। इसकी औसत पैदावार लगभग ३०० क्विन्टल तक मिल जाती है।

इन दोनों किस्मों की प्याज को सलाद के लिए भी काम में लाया जा सकता है क्योंकि देशी किस्मों की अपेक्षा ये कम तीखी होती हैं।

चूजों को सर्दी लगने पर सावधानी

सर्दियों में मुर्गियां, खासकर ब्रूडर वाले चूजे अक्सर ठंड खाकर मर जाते हैं। वैज्ञानिकों का कहना है कि कमरे का तापमान उचित रख कर उन्हें मरने से बचाया जा सकता है।

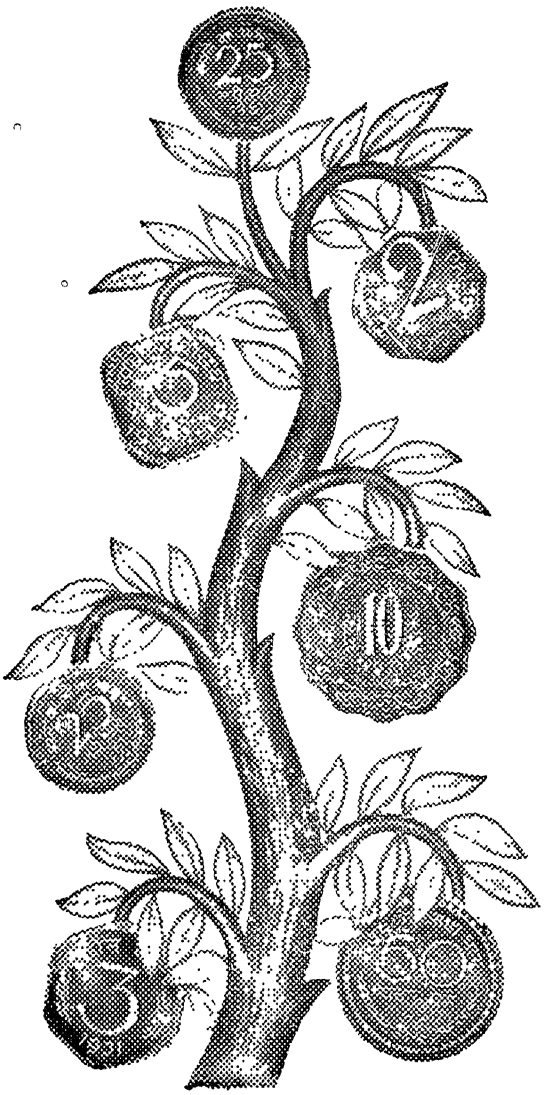
इसके लिये ब्रूडर में तापमान की नियमित रूप से जांच करते रहना चाहिये। अधिकतम-न्यूनतम थर्मामीटर की मदद से तापमान की जांच २४ घंटे में कम से कम तीन-चार बार करनी चाहिये। ब्रूडर के किनारे के पास बिछावन से पांच सेन्टीमीटर ऊपर थर्मामीटर रख कर सही तापमान के बारे मे खास सावधानी बरतनी चाहिये। वैज्ञानिक ब्रूडर के नीचे इस प्रकार तापमान रखने का सुझाव देते हैं :—

पहले सप्ताह ९०° फैरनाहाइट चौथे सप्ताह ७५° फैरनहाइट
दूसरे सप्ताह ८५° फैरनहाइट पांचवे सप्ताह ७०° फैरनहाइट
तीसरे सप्ताह ८०° फैरनहाइट छटे सप्ताह ७५° फैरनहाइट

सर्वोत्तम परिणामों के लिये कमरे का तापमान ७५° फैरनहाइट के आस पास रखने की सलाह दी जाती है।

ब्रूडर को गर्म रखने के लिये बुखारी या अंगीठी ज्यादा अच्छी रहती है बशर्ते धुआं निकालने की व्यवस्था हो। बुखारी का सबसे अच्छा इस्तेमाल करने के लिये इसके ऊपर होवर लगा दें। यह गर्म होकर फर्श को भी गर्म कर देगा।

MONEY GROWS ON TREES



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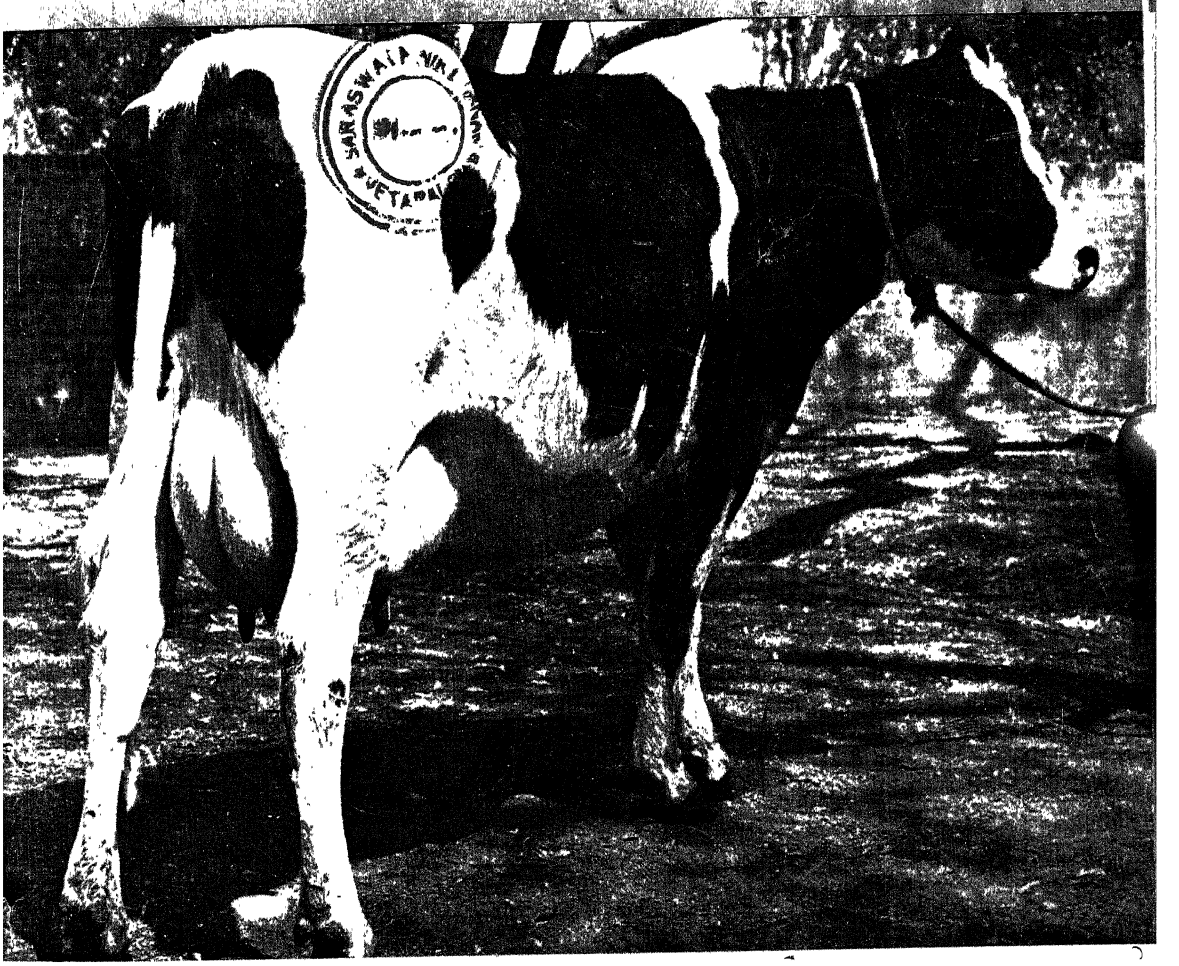

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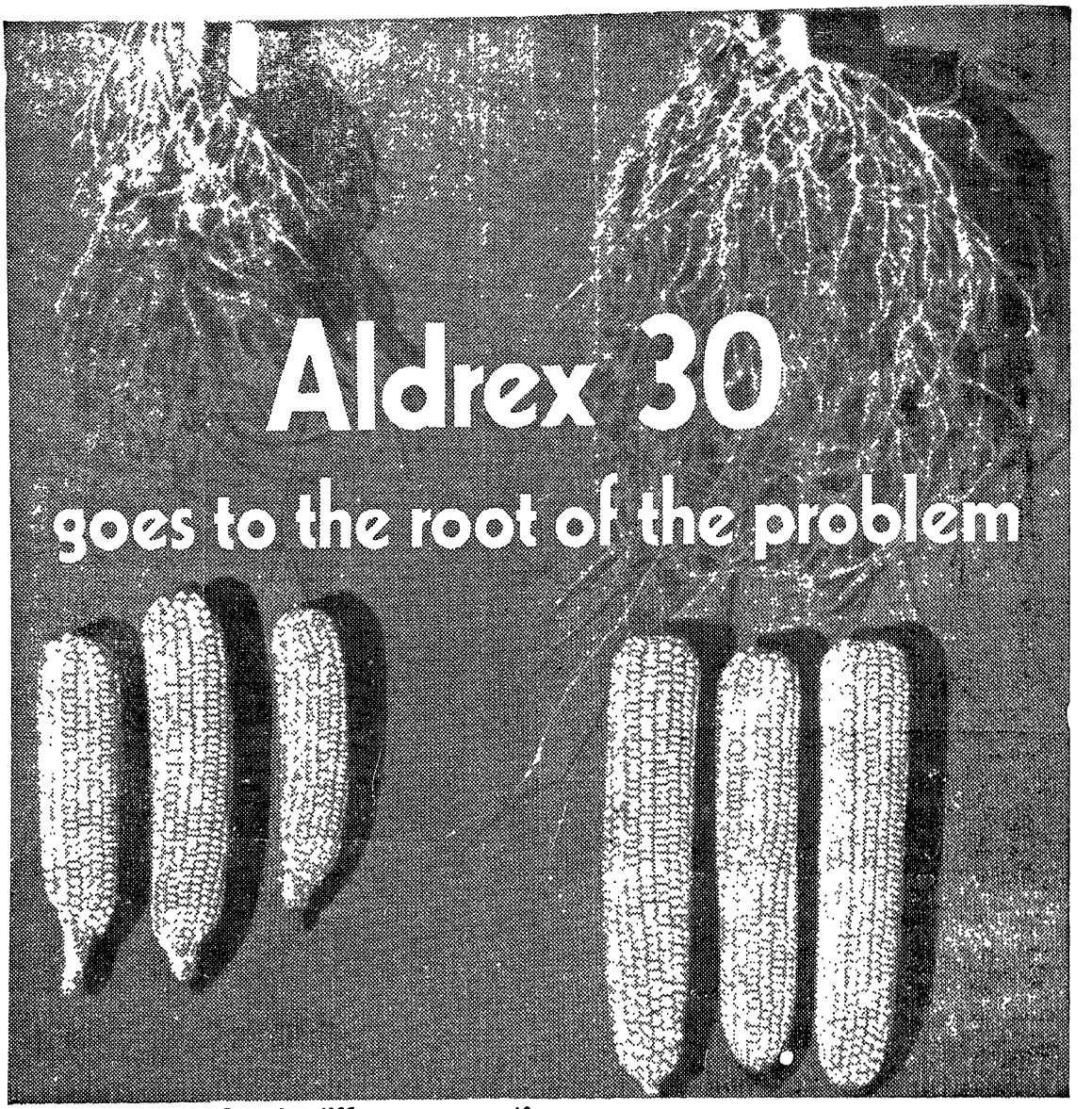

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O learned people! I advise you to give special place to fire and make full use of it as in this world it helps in producing food, provides worldly comforts and enjoyments and acts like an envoy for the achievement of cherished objects.

Yajur Veda, Chapter 22,
Mantra 17.

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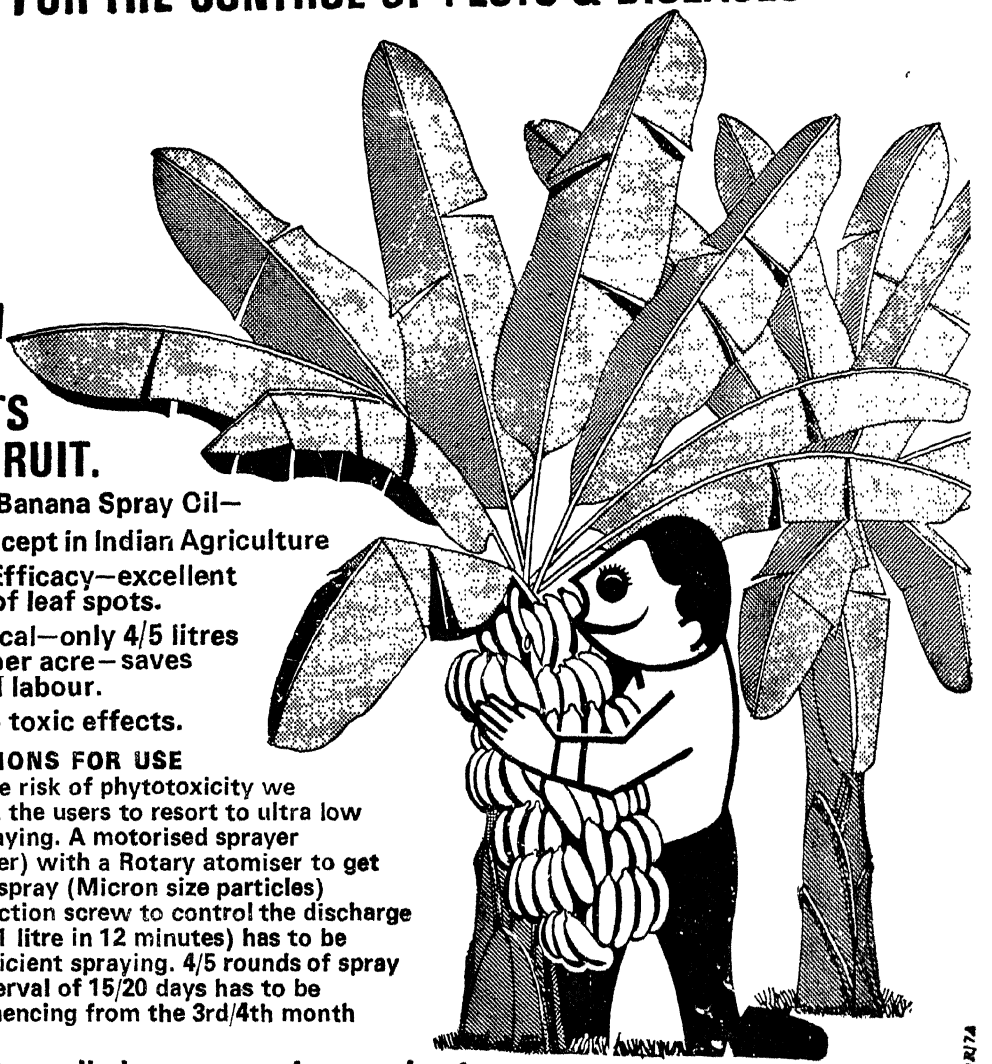

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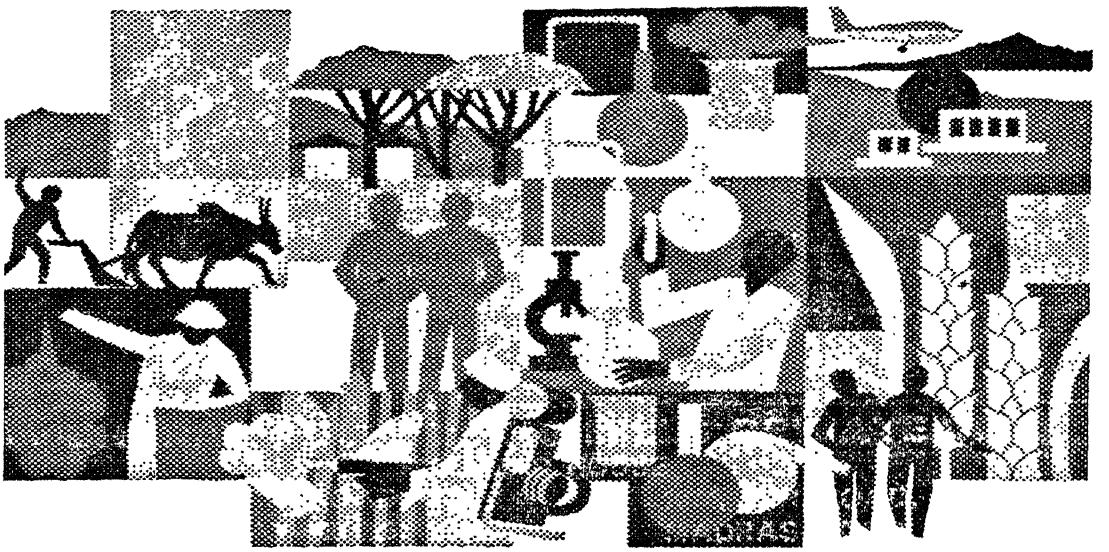

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A New Cotton

CBS-156, a unique long staple cotton recently released by the Tamil Nadu Agricultural University, is claimed to be superior to the popular hybrid cottons, H-4 and Varalaxmi.

The new variety is capable of giving four quintals additional *kapas* per acre, it is reported.

The variety belongs to the category of extra long staple superfine cotton with a staple length of 36 mm., compared to 50 counts of H-4, 60 counts of Varalaxmi and 70 counts of MCV-4 and 90 counts of Sujata. CBS-156 spins 120 counts equivalent to imported superfine Egyptian cotton. Its lint also is finer and stronger.

This is a 170 day crop resistant to stem weevil and moderately resistant to *verticillum* wilt disease.

In farmers' fields CBS-156 has registered an yield upto 15 quintals *kapas* with a maximum profit of Rs. 12000 per acre. Average profit that can be expected is Rs. 7500 an acre—FIU.

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